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ABSTRACT

Presents a detailed discussion of the data collected on calculator and computer use in schools in 20 countries. The document includes discussion of: (1) school policy on calculator use; (2) description of populations A (8th grade students) and B (12th grade students) in the United States; (3) uses of calculators in subjects other than mathematics; (4) type and frequency of teacher use of calculators; and (5) student uses and attitudes. The data indicates there was limited use made of calculators by Population A. More Population B students than Population A students made use of the calculator. Neither population made much use of the computer. Attitudes were found only slightly more positive than negative toward using calculators and computers. (PK)

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The Use of Calculators and Computers in Mathematics Classes in Twenty Countries: A Source Document

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Second International Mathematics Study

The Use of Calculators and Computers in Mathematics Classes in Twenty Countries: A Source Document

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September 1986

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The Use of Calculators and Computers

in Mathematics Classes in Twenty Countries

A Source Document

September 1985

Gail Jaji, University of Illinois at Urbana-Champaign

As a part of the Second International Mathematics Study, data on calculator and computer use in schools in twenty countries were collected.

The Second International Mathematics Study involved two distinct populations:

> Population A: All students in the grade in which the modal number of students attained the age of 13.0-13.11 years by the middle of the school year (for the U.S.A. this was eighth grade).
>
> Population B: All students who were in the normally accepted terminal grade of the secondary education system, and who studied mathematics as a substantial part (approximately five hours per week) of their academic program (in the U.S.A. this is the twelfth grade).

Notes on the characteristics of the target populations:

Population A

Across all countries, this target population tended to encompass virtually all students in the age cohort. It should be noted that in Japan and Hong Kong, twelve year olds rather than thirteen year olds were selected for study.

Population B

In contrast to Population A, this group is a select group, and varies in selectivity (among other characteristics) across countries. The countries vary greatly in the proportion of children retained in school, from a low of 17 percent in England/Wales and New Zealand, to a high of 92 percent in Japan. Of those children that are still in school, the proportion that is studying advanced mathematics varies, as well. As a result, in England and Wales only about 6 percent of the age cohort is in advanced mathematics. In Hungary, all students who remain in school study

advanced mathematics. Therefore, about 50 percent of the age cohort of Hungarian students is in Population B.

The ages of students in Population B varies a great deal, as well. The mean age for for U.S. Population B students was 17 years 9 months while for Scotland it was only 16 years 10 months and for Sweden it was 19 years 2 months. For most countries the mean age was close to 18 years.

The data on the target populations were collected by means of three basic questionnaires for each population: 1) a school questionnaire, 2) a teacher questionnaire, and 3) a student questionnaire. The number of schools, teachers, and students involved from each country are in Table 1.1.

1. School Policy on Calculators

School policies on the use of calculating devices are described in terms of percentages of schools having similar policies on the use of calculating devices. Teacher reported usage in terms of how often they use calculators or computers and the type of use to which these devices are put and student reported usage and attitudes toward that usage will be described on a country by country basis using percentage. The figures reported are the percentage of the total sample reporting that usage and not the percentage of only those responding. The data were handled in this manner because of the strong indications that no response was quite likely due to non use. Throughout the data there was a fairly high non response rate and the reader should remember that the data may thus only be seen as a trend and interpreted very cautiously.

The Head of the Mathematics Department of each school was asked to respond to the following question:

> Which of the following best describes your department's policy on the use by students of "four function" calculators in the mathematics classroom? (check one)
>
> --No policy formulated. Teachers allow use as they see fit.
>
> --Students are forbidden to use calculators in the classroom.
>
> --Students may use calculators, but they are not provided by the school.
>
> --Calculators are provided by the school, but used only rarely in the classroom.

--Calculators are provided by the school and used frequently in the classroom.

--Question does not arise (e.g., calculators are not available to students).

A parallel question on programmable calculators was used, as well.

1.1 Population A

An examination of Tables 1.2 and 1.3 and Figures 1.1 and 1.2 reveals that while the patterns of policy were similar for programmable calculators and four-function calculators they were not identical. With respect to four-function calculators, a greater percentage of Population A schools (median = 25 percent) had no policy regarding use of calculators than any other form of response. About 50% of the schools in the USA, Luxembourg and Ontario, Canada had no policy regarding the use of calculators, either four function or programmable. A median of only 20 percent of the Population A schools had no policy concerning the use of programmable calculators. In some countries, the use of calculators is forbidden in a substantial number of Population A classrooms. About 70 percent of the schools in Scotland forbid the use of four-function calculators (the median for all countries was about 18 percent). Sixty-three percent of the schools in Scotland forbid the use of the programmable calculator (the median for all countries was about 22 percent).

It appears that greater numbers of Population A classes are free to use calculators without their being provided than classes where calculators are actually provided. In very few classes are calculators reported as being used frequently. In Sweden 25 percent of the department heads report frequent use. For all countries the median was 5 percent for four-function with a range of 0 to 25. The overall picture appears to be one of quite limited use of either type of calculator in Population A classes. Even in the U.S.A. where calculators are considered inexpensive and readily available, very little use was reported.

While a median of about only 25 percent of all countries reported programmable calculators to be unavailable, programmable calculators were reported unavailable in all classes in French Belgium. Four-function calculators were more frequently available (the international median for unavailabity was 10 percent). Only in Swaziland did unavailability reach 50 percent. In spite of general availability, few Population A classes overall reported use of calculators.

1.2 Population B

Policies in Population B classes present quite a different picture of calculator usage from Population A. (See Tables 1.2 and 1.3 and Figures

1.3 and 1.4.) In about 55 percent of the United States classes no policy exists. Teachers therefore appear to have freedom to use or not use calculators as they see fit. This was reported by about 35 percent of the Japanese classes (the median for all countries was about 20 percent). The overall picture was the same for both four-function and programmable calculators. Only a very small percentage of schools forbid the use of calculators in Population B (median about 2 percent as contrasted with about 20 percent in Population A). Again, reported freedom of use without providing the calculators was quite high in Population B (a median of about 45 percent for both four-function and programmable calculators). Small numbers of classes reported provision of calculators with infrequent use and similar numbers provision with frequent use, but frequent users are higher than rare users. A small number of schools reported unavailability of calculators. Thus the picture in Population B is one of fairly substantial use of calculators.

1.3 Use of Calculators in Mathematics and Other Subject Areas

In a very high percentage of classes in Population A, use of the calculator is not encouraged in any subject (median about 62 percent) while in Population B the median is only about 3 percent. (See Table 1.4 and Figures 1.5 and 1.6.) Use of the calculator is encouraged most often for appropriate subjects (the median being 55 percent in Population B but only about 15 percent in Population A). This is followed by encouragement for use in mathematics and science (median about 20 percent in Population B and 5 percent in Population A - note in Population A use in mathematics only is encouraged more often - median 10 percent). Thus again the picture emerges of greater use with Population B than with Population A. However, around 80 percent of the classes in Japan and Thailand do not encourage the use of the calculator in Population B.

2. Teacher Uses of Calculators

Within the constraints of school policy, the data indicate that many teachers have a great deal of freedom to decide when and how they will have their students make use of calculators. In this section, data are presented on how frequently teachers use calculators in mathematics classes and the types of use they encourage their students to make of the calculator.

2.1 Frequency of Use

Teachers were asked to respond to the following question:

> In your target class, about how often are calculators used in mathematics? (Check one alternative in each column.)

	Four-function	Pre-programmed Scientific and/or Programmable
During two periods per week		
During one period per week		
Occasionally (not every week)		
Never		
Calculators not allowed		

2.1.1 Population A

Examination of Table 2.1 and Figure 2.1 reveals that in most countries very little use is made of programmable calculators in Population A. More than half the countries reporting 35 percent higher never use them and in 20 percent or higher of the classes calculators are not permitted. Even with four-function calculators a very high percentage of the teachers report that calculators are either not allowed or never used. Over 80 percent of the teachers in Swaziland, Japan and Hong Kong report they never use four-function calculators and over 50 percent of the teachers in Scotland and the Netherlands say use of calculators is not permissable. Where calculators are used at all, only occasional use is reported for most of the classes. Only Sweden reports more than fifty percent of the teachers use four-function calculators occasionally. For all other countries less than forty percent report they occasionally use four-function calculators. In the U.S.A. 29 percent use calculators occassionally whereas 33 percent never use them and 30 percent say they are not permitted to use them; only 6 percent report frequent use. Note here that there is a very high non-response rate (from the school data it would seem likely that many of the non-respondents do not use calculators).

2.1.2 Population B

The picture is considerably changed when looking at the use of calculators in Population B. (See Table 2.1 and Figure 2.2.) An almost negligible number of teachers report that calculators (either four-function or programmable) were not allowed. The overall picture from the teacher is consistent with the school data. For over half of the countries less than fifteen percent of the teachers report that they never use calculators (either four-function or programmable). A notable exception is Japan which reports approximately 85 percent of the teachers never use calculators. Most countries report that between 10 and 25 percent of their teachers use four-function two or more periods per week and between 30 and

45 percent use programmable calculators that often. Once per week use is reported as being between two and ten percent for four-function calculators and between two and fifteen percent for programmable calculators. Between ten and thirty-five percent of the teachers report occasional use of the four-function calculators and fifteen and twenty-five percent for the programmable calculator.

2.2 Types of Use

Teachers were asked to respond to the following question:

> Which of these do you encourage your (target class) students to do? (Fill in each cell with N for No, Y for Yes).

	Four-function Calculator	Pre-programmed (Scientific) and/or Programmed Calculator	Computer
To check answers to exercises			
To do homework			
As an aid to solve problems			
To take tests			
As an aid to do projects			
For recreation			

2.2.1 Population A

The responses of Population A teachers are tabulated in Tables 2.2 and 2.3 and in Figures 2.3 and 2.5. Population A teachers tended to encourage the use of the four-function calculator, computer or a combination of these. Use of the calculator (either four-function or programmable) is most highly encouraged for checking answers (median = 32 percent). The greatest percentage of teachers encouraging this use is in Japan followed by Ontario, Canada. Another popular use was for recreation (median = 27 percent) with the greatest percentage of teachers encouraging this use. Very few teachers encourage students to use the calculator for tests, (median = 5 percent) or for doing homework (median = 11 percent). For doing projects, homework, taking tests, checking answers and problem solving, 90 percent of the countries in the study report less than 50 percent of their teachers encourage these uses and even for recreation more than seventy-five percent of the countries report less than 50 percent of

the teachers encourage this usage. Therefore, it can be seen that few teachers of Population A students encourage much usage of calculators.

In interpreting the results it must be pointed out that for these data over fifty percent of the teachers did not respond to the question. From this lack of response one can surmise that calculators were probably not in use. The previous data and data from the schools tend to support this premise.

2.2.2 Population B

Quite a different picture of calculator usage is presented for teachers of Population B. (See Tables 2.2 and 2.3 and Figures 2.4 and 2.6.) As school data have already shown calculator use is more prevalent in Population B than in Population A, these also showed that the programmable calculator was given greater preference. The most popular use of the calculator among teachers of Population B was for problem solving with over 75 percent of the countries reporting that over 60 percent of the teachers encourage this usage (median = 83 percent). Another very common use was for doing homework with over 75 percent of the countries reporting over 60 percent of the teachers encourage the use (median = 70), though only 25 percent of teachers in Japan and Thailand encouraged this use. Taking tests with the calculator was also encouraged in quite a few classrooms (median = 68) with 75 percent of the countries indicating over 50 percent of teachers encourage this usage with the majority of teachers in British Columbia, Hungary, Japan and Thailand not encouraging this use. At this level, while recreational use of the calculator was still encouraged by a substantial percentage of teachers this was the least popular use among these teachers (median = 39 percent) followed by use for doing projects (median = 47 percent). Interestingly, a very high percentage of teachers in Japan encouraged recreational and project use (65 percent and 86 percent respectively). Teachers in the United States also tended to encourage these two uses fairly substantially.

The data clearly indicate that many more teachers of Population B than of Population A encourage calculator usage. It is also noted that populations differ in the type of calculator use that is made. Population A teachers rate highest uses for checking answers, doing projects and for recreational purposes. Population B teachers give high ratings for problem-solving and doing homework.

3. Student Uses and Attitudes

Students were asked where they used calculating devices, how they used them and how they felt about their use.

3.1 Where Calculators and Computers Are Used

Students were asked:

> Do you use one or more of the following aids at home, in your mathematics class, or in any class other than mathematics?

Aids	Within Home	In Mathematics Classes	In Other Class
A Abacus (Soroban)			
B Slide rule			
C Simple calculator (four-function)			
D Scientific Calculator Programmable multi-function			
E Programmable calculator			
F Micro-computer or computer terminal			

Their responses are tabulated in Tables 3.1 and 3.2 and displayed in Figures 3.1, 3.2, 3.3 and 3.4.

3.1.1 Population A

The response pattern seems to show that most of the students who used a calculator used a four-function calculator at home. Only a small percentage used calculators in mathematics classes and an even smaller percentage used them in other classes. A dramatic exception was found in the case of France and Ontario, where it was reported that more than 50 percent of the students used calculators at home. Only Sweden had a large percentage of students using calculators in mathematics classes (46 percent) whereas most countries reported less than 10 percent used them there. When it comes to the computer Japan was the only country reporting as high as 10 percent used them at home. For all other countries the percentage was less than 10 percent for all categories of usage.

3.1.2 Population B

The programmable calculator was the more popular device except in Japan where the four-function calculator was more popular for home and other class use. In Belgium (both Flemish and French) only the four-function was reported to be used. Among Population B students it was generally common to use the calculator in all three places (home, mathematics class and other classes). Mathematics class was the most popular place to use calculators followed by home. About 90 percent of the students in England and Wales and Sweden reported using calculators at home and in mathematics class. Hungary, Japan and Thailand report consistent low usage and Israel reports non usage in mathematics class. Only Hungary had a large percentage reporting non-use of the calculator. As with Population A computer use was not very common with Sweden showing the greatest use in mathematics classes (22 percent) and the general trend being to use the computer in other classes rather than in mathematics class or at home.

Also of interest here is the fact that only three countries (Japan, Hong Kong and Thailand) report any significant use of the abacus. For all three countries both Population A and Population B students reported using the abacus at home only. This traditional calculating device thus also receives no usage in the schools.

3.2 How Calculators and Computers are Used

Students were asked:

> What uses do you make of simple calculators, scientific or programmable calculators and micro-computers or computer terminals?

In School	Calculator		Programmable Calculator		Computer Terminal	
	Yes	No	Yes	No	Yes	No
A Purely for checking answers						
B As an aid in solving problems						
C For taking tests						
D As an aid in doing projects						
E For recreation						
At Home						
F To do homework						

3.2.1 Population A

The four-function calculator was used more often than the programmable calculator or computer and thus we look mainly at the use made of the four-function calculator. (See Tables 3.3 to 3.9 and Figures 3.5 to 3.11.) It was used by over 25 percent of the students for checking answers in about 50 percent of the countries involved in the study. Notable exceptions to the use of the four-function calculators for checking answers were French speaking Belgium where around 60 percent reported using programmable calculators and Luxembourg where over 40 percent used the programmable calculator. However, in French Belgium, all department heads reported programmable calculators were unavailable. Very few students reported using the computer. The majority of students in Thailand, Flemish Belgium and New Zealand reported not using any calculating device for checking answers.

For solving problems only about one-half of the countries had over 25 percent of the students reporting use of the four-function calculator. With the exception of French Belgium and Luxembourg few countries had students who reported using programmable calculators for problem solving. Again, the computer was not used for problem solving by over 90 percent of the students with the exception of Israel (17 percent) and Ontario, Canada (45 percent).

For taking tests no calculating device was used in the majority of countries. Only French Belgium (76 percent) and Luxembourg (66 percent) had more than about 20 percent reporting use of any calculating device for test taking. Few teachers permit or encourage the use of calculators for testing at this level.

Project work had even less usage, with no country reporting more than 20 percent usage for any one device. Several countries reported no usage, suggesting that perhaps projects were not a common part of the school program.

The four-function calculator was again more popular for recreational purposes. But over one-half of the countries reported less than 15 percent used them for this purpose. While the programmable calculator received even less use in most countries it is interesting to note that French Belgium and Luxembourg both had more than one-half of their students reporting this usage.

The four-function calculator was quite popular for homework with over half the countries reporting more than 30 percent used it for this purpose. France had 64 percent of its students reporting they used the four-function calculator for doing homework. Again French Belgium and Luxembourg had around 50 percent of the students indicating that they used the programmable calculator for doing homework.

When one examines overall usage of calculators in general (Table 3.9 and Figure 3.17) it is found that Population A students tend to use

calculators mainly for checking answers and doing homework. The next most frequent uses are for problem solving and recreation. Teachers reported that they encouraged the use of the calculators for checking answers. This agrees with student reports. But, by contrast, teachers gave low priority to using calculators for doing homework and high priority for using them for recreation. This is the reverse of what students reported they did. Both doing projects and taking tests show less than 10 percent using calculators for this purpose in more than half the countries. On the whole, using calculators on tests was least popular with students in most countries. This tended to agree strongly with what teachers also said. Note, however, that in French Belgium and Luxembourg test taking with calculators seems to be an acceptable practice among students with around 75 percent reporting this use. This contrasts with the very low percentage of teachers in these countries reporting they encouraged this use.

3.2.2 Population B

The pattern of use changes somewhat from that found for Population A. The majority of students used the programmable calculator. (See Tables 3.3 to 3.9 and Figures 3.12 to 3.18.)

In one-half of the countries over 25 percent of the students report using the programmable calculator for checking answers and almost half report use of the four-function calculators by over 20 percent. With the exception of Ontario, Canada (69 percent) and Israel (19 percent) less than 4 percent in all countries involved in the study report use of the computer. In Ontario, Canada 30 percent report using all three types of calculating devices (four-function calculators, programmable calculators and computers).

For solving problems, over 50 percent of the students in one-half of the countries reported using the programmable calculator for solving problems. Over 30 percent reported using the four-function calculator for this purpose. The computer received a little more use for this purpose but the median was still only 5 percent.

Taking tests with calculators appeared to be fairly common at this level. In half the countries nearly 60 percent or more reported using a programmable calculator for taking tests.

Doing projects with calculating devices does not seem to be a frequent occurrence in most of the countries. Only Sweden and Hong Kong reported more than 65 percent of the students used programmable calculators for projects. The median for project use was about 20 percent for programmable calculators and much less for all other categories.

Recreational use was not very common, with the median for programmable calculators being only about 22 percent. It appears a few more students use the computer for recreation than for other purposes but again it is a very small group (median = about 7 percent). But from the

evidence available most students who used the computer seem to have used it mainly for recreational purposes.

Doing homework was again a time for using the programmable calculator with over 60 percent using it for this purpose in just under half the countries involved in the study.

Turning to the overall picture of the usage of calculators, we find that the greatest percentage of students use calculators for doing homework (median = 92 percent). This is followed by problem solving (median = 85 percent) and test taking (median = 70 percent). By contrast, teachers reported that they gave greater encouragement to using calculators for problem solving than for doing homework. The least popular use at this level appears to be for recreation (median = 26 percent). This was in agreement with the priority given by teachers. Projects and checking answers seemed to occupy similar postions with both having medians around 45 percent.

It is of interest to note much more extensive use of the calculator among Population B students than with Population A students. It is also interesting to observe the change in emphasis on the use that is made of the calculator. Both groups used the calculator extensively for doing homework but Population B students made extensive use of the calculator for problem solving and taking tests while these received little emphasis by Population A students. And while Population A students emphasized checking answers and recreation, these activities received little attention from Population B students. Neither group made much use of the computer.

3.3 Student Attitudes Towards Calculators

Students were asked to express on a five point scale ranging from strongly disagree to strongly agree, the extent to which they agreed with the feelings expressed in the following statements:

> Solving word problems is more fun if you use a hand-held calculator.
>
> If you use a hand-held calculator you do not have to learn to compute.*
>
> It is less fun to learn mathematical ideas if you use a hand-held calculator.*
>
> Using a hand-held calculator con help you learn many different mathematical topics.

*For purposes of analysis these items were reversed when scored.

3.3.1 Population A

The results for Population A are summarized in Tables 3.10 and 3.11. Seventy percent of the Population A students in Canada (Ontario) feel that learning mathematics with a calculator is more fun whereas only 14 percent of the students in Japan feel this is true. On the whole the feeling is more in agreement than disagreement that using a calculator makes learning mathematics more fun but this is not true for every country (see Figure 3.17).

Sixty-one percent of the students in Canada (Ontario) felt that you still had to learn to compute if you used a calculator but only 11 percent of the students in Thailand felt this was so.

The usefulness of the calculator for learning topics was questioned by quite a number of students in some countries, fifty percent in Ontario, Canada, Israel, Luxembourg, Netherlands and Nigeria felt that the calculator was not very useful in learning many topics. A greater number of students felt that problem solving was more fun with a calculator than those who didn't but again it was not a majority. Only French Belgium and Ontario, Canada had more than fifty percent of the students agreeing that problem solving was more fun with a calculator.

Median polish was used in order to help identify row or column effects in the data. The data in Table 3.11 indicate little agreement among the Population A students in the various countries concerning the use of the calculator. Students in Ontario, Canada are more positive towards the use of calculators than students in any of the other countries. Students in Hungary saw learning mathematics with a calculator much more positively than did students in other countries. Students in Luxembourg were much more convinced that when using a hand-held calculator it was still necessary to learn to compute than were students in other countries. In Japan, students more clearly saw the use of the calculator in learning other topics than did students in other countries.

3.3.2 Population B

Population B students appear, in general, to be more positive about the use of the calculator than do the Population A students. In more than half the countries over 75 percent felt learning mathematics with calculaors was more fun. In only two countries were the percentages agreeing that it was more fun to learn mathematics with a calculator less than fifty percent (Ontario, Canada - 44 percent and Israel - 38 percent).

On the whole, most students felt one still has to learn to compute when using a calculator. In most countries the percentage holding this opinion hovered around 50 percent while those feeling one did not have to learn to compute hovered around 30 percent. Students were noncommittal when it came to the view that using calculators helps one learn many topics. In most countries the agreement and disagreement percentages were

nearly equal. Only Thailand reported more than 50 percent in disagreement. French Belgium, Ontario, Canada, Hong Kong and Sweden were markedly more positive in seeing calculators as helpful in learning many topics while Israel, Japan, New Zealand and Thailand were distinctly more negative in their views. Nearly equal numbers agreed and disagreed with the view that solving word problems is more fun if you use a hand-held calculator.

Median polish (Table 3.11) reveals positive column effects on "fun to learn with a calculator." This suggests much more positive attitudes on this aspect of calculator use than on any of the others, though as a whole attitudes could be seen to be positive. It can be seen that Finland and Hungary hold more positive attitudes on the matter of fun to learn with calculators than other countries, while Ontario, Canada, Hong Kong and Israel differ markedly from the other countries by holding very negative attitudes on this topic.

3.4 Student Attitudes Towards Computers

Students were asked:

Tell, on a five point scale, how much you agree with the feelings expressed in each statement below.

*Using computers makes learning mathematics mechanical and boring.

A	B	C	D	E
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

Everyone should learn something about computers.

A	B	C	D	E
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

Computers solve problems better than people do.

A	B	C	D	E
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

Computers do lots of good things for people.

A	B	C	D	E
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

*Scoring was reversed.

3.4.1 Population A

While there was little consensus among Population A students, on the whole they might be characterized as being slightly more positive than negative about computers. Students in Canada (both Ontario and British Columbia), France, New Zealand, Nigeria, Scotland and the USA held fairly positive views while students in Luxembourg, Israel and Hungary held slightly negative views, particularly as relates to the idea that everyone should learn something about computers. See Tables 3.12 and 3.13. Median polish suggests that students in British Columbia, and the United States held consistently positive views while those in Japan were consistently negative. Again, taken as a whole, attitudes appear to be fairly positive.

3.4.2 Population B

These students held fairly mixed views on computers. They tended to feel that computers did not solve problems better than people and most decidedly felt that using computers made learning mathematics mechanical and boring. On the other hand there was a fairly strong consensus that everyone should learn something about computers and that computers do lots of good things for people. Students in England and Wales seem to have cast a dissenting vote feeling that not everyone needs to learn about computers and that computers do not do lots of good things for people. Students in Hong Kong and in Israel do not find learning mathematics with a computer mechanical and boring.

Population B students were asked:

How do you feel about each of these activities?

Using a hand-held calculator

Important - Not Important

A	B	C	D	E
Very Important	Important	Undecided	Not Important	Not at all Important

Easy - Hard

A	B	C	C	E
Very Easy	Easy	Undecided	Hard	Very Hard

Like - Dislike

A	B	C	D	E
Like a lot	Like	Undecided	Dislike	Dislike a lot

The results of their responses are reported in Table 3.14 with the two positive categories taken together and the two negative categories taken together for each of the three parts. It is quite clear that on the whole Population B student attitudes are quite positive toward using calculators. They are most positive about ease of use and least positive about importance. It should be noted that Japan is considerably less positive than other countries as regards the use of calculators and in terms of importance a greater percentage of Japanese students see the use of calculators as unimportant than see it as important. This latter is also true for Hungary and Thailand. There is also a fairly substantial percentage of students in Thailand who dislike using a calculator even though the majority report liking it. No data were available on this question for Population A. Median polish reveals the consistently negative views held by Thailand students as compared with other countries. Additionally median polish points out the less positive attitudes of students from Thailand, Japan, and French Belgium as compared with the other countries in the study. Finnish students are the most consistently positive in their views.

4. Comparison of Attitudes with Frequency of Use

In those two countries where there was little use of the calculators among Population B (Japan and Thailand) students also held less positive views about the use of calculators. The reverse (countries where frequent use was made holding more positive views) was not apparent. For the populations as a whole it appears that Population B, which made greater use of calculators, also held more positive views than Population A (which made much less use of the calculators). (See Table 3.15.)

5. Summary

At the time the data were collected there was limited use made of calculators among Population A students. School policy was somewhat negative towards use of calculators among this group. When students did use them they tended to use four-function calculators at home for doing homework, checking answers and for recreation.

Many more Population B students than Population A students made use of the calculator. School policy and teacher encouragement was much more positive for this older, more mathematically advanced group. They tended to use the programmable calculator both at home and at school although on the whole home use was more extensive. They tended to use calculators for problem solving and doing homework, with recreation the least popular use.

Neither Population A nor Population B students made much use of the computer though Population B made somewhat greater use of it and used it mainly in classes other than mathematics.

On the whole, attitudes were only slightly more positive than negative toward using calculators and computers. Population B attitudes were more positive than those of Population A. There seemed to be little relationship between attitudes and the extent of use of calculators.

Table 1.1
Sample Sizes of Schools, Teachers and Students from Each Country: 1981

Country	Schools N	Teachers N	Students N
POPULATION A			
Belgium (Flemish)	151	154	1385
Belgium (French)	84	105	2054
Canada (British Columbia)	89	89	2158
Canada (Ontario)	115	173	4885
England and Wales	94	244	2054
Finland	98	206	4484
France	179	347	8329
Hong Kong	125	130	5548
Hungary	70	70	1754
Israel	81	140	3587
Japan	212	212	8091
Luxembourg	42	107	2106
Netherlands	236	236	5500
New Zealand	100	189	5218
Nigeria	42	45	1456
Scotland	76	354	1356
Swaziland	24	25	904
Sweden	97	186	3585
Thailand	98	99	3821
USA	157	276	6683
POPULATION B			
Belgium (Flemish)	131	180	2858
Belgium (French)	79	151	2018
Canada (British Columbia)	78	95	1948
Canada (Ontario)	76	187	3190
England and Wales	312	613	3436
Finland	81	81	1550
Hong Kong	112	125	3294
Hungary	91	94	2443
Israel	64	82	1810
Japan	192	207	7954
New Zealand	79	79	1186
Scotland	54	218	1501
Sweden	127	127	2712
Thailand	64	107	3747
USA	150	250	4643

Table 1.2
Four-Function Calculators:Mathematics Department Policy on Their Use as Reported by Department Heads: 1981

Country	Percent Reporting				
	No Policy	Calculator Forbidden	Limited Use	Frequent Use	Calculator Unavail.	No Re. sponse
Population A						
Belgium(Fl)	23	53	13	3	6	2
Belgium(Fr)	45	15	32	4	0	4
Canada(BC)	48	24	16	1	4	7
Canada(On)	51	15	14	3	16	1
England/ Wales	28	20	41	9	2	1
Finland	22	16	34	3	23	1
France	32	9	23	4	20	13
Hong Kong	22	45	15	0	8	10
Hungary	17	21	11	0	46	4
Israel	23	5	19	2	23	27
Japan	23	24	46	1	6	0
Luxem.	52	17	26	0	2	2
Nether.	19	58	16	3	0	4
New Zea.	41	9	40	4	6	0
Nigeria	7	55	10	0	24	5
Scotland	4	67	16	1	5	7
Swaziland	25	4	4	0	58	8
Sweden	14	1	40	25	1	19
Thailand	13	29	14	0	39	5
USA	52	13	18	1	15	2
Population B						
Belgium(Fl)	21	2	39	24	11	2
Belgium(Fr)	28	0	46	22	0	5
Canada(BC)	31	10	10	0	3	46
Canada(On)	12	0	83	1	1	3
England/ Wales	10	1	77	7	2	4
Finland	23	0	66	7	4	0
Hong Kong	22	3	64	0	1	10
Hungary	29	8	57	3	3	0
Israel	19	0	60	8	0	14
Japan	36	24	32	1	5	3
New Zea.	16	0	74	8	3	0
Scotland	2	4	82	9	2	2
Sweden	1	0	2	4	2	92
Thailand	31	8	28	0	19	14
USA	54	2	31	9	1	3

*This category includes both those reporting may use but calculators not provided and calculators provided but rarely used.

Table 1.3
Programmable Calculators: Mathematics Department Policy on Their Use as Reported by Department Heads, 1981

Country	Percent Reporting					
	No Policy	Calculator Forbidden	Limited Use	Frequent Use	Calculator Unavail.	NR
Population A						
Belgium(Fl)	21	56	7	1	15	2
Belgium(Fr)	0	0	0	0	100	0
Canada(BC)	44	23	7	1	20	6
Canada(On)	47	14	9	1	28	1
England/ Wales	22	23	27	3	23	1
Finland	14	16	11	2	55	1
France	16	9	10	2	56	7
Hong Kong	14	46	14	0	18	7
Hungary	0	0	0	0	0	100
Israel	12	9	14	1	36	28
Japan	23	23	38	0	15	1
Luxem-	48	31	10	0	7	5
Nether-	19	59	14	3	0	5
New Zea-	45	10	13	0	32	0
Nigeria	12	52	5	0	29	2
Scotland	3	63	8	1	20	5
Swaziland	17	8	4	0	63	8
Sweden	4	0	7	9	0	79
Thailand	13	22	16	0	45	3
USA	52	11	8	2	26	1
Population B						
Belgium(Fl)	19	0	43	34	2	1
Belgium(Fr)	32	0	39	15	10	4
Canada(BC)	28	1	59	5	1	5
Canada(On)	16	1	77	0	3	3
England/ Wales	12	4	73	5	4	2
Finland	16	6	60	6	11	0
Hong Kong	28	6	51	0	6	9
Hungary	22	7	30	2	37	1
Israel	20	0	58	8	0	14
Japan	35	12	42	4	4	3
New Zea.	23	0	70	4	4	0
Scotland	7	9	76	2	2	4
Sweden	2	0	18	79	0	2
Thailand	30	6	23	2	27	13
USA	56	3	27	5	7	2

*This category includes both those reporting may use but calculators not provided and calculators provided but rarely used.
NR = No Response

Table 1.4
Subjects in Which Calculator Use is Encouraged
as Reported by Department Heads: 1981

Country	None	Math Only	Percent Science Only	Reporting Math/ Science	Appropri. Subjects	N R
POPULATION A						
Belgium (FL)	79	3	3	5	8	3
Belgium (FR)	57	10	1	6	24	2
Canada (BC)	51	3	1	9	34	2
Canada (ON)	57	12	0	3	26	2
England/Wales	30	20	5	20	33	2
Finland	28	0	14	27	27	5
France	55	22	1	16	5	2
Hong Kong	70	4	1	11	12	2
Hungary	57	13	0	6	13	11
Israel	63	19	2	7	5	4
Japan	85	10	0	3	1	1
Luxembourg	62	24	0	2	10	2
Netherlands	83	4	2	3	4	3
New Zealand	61	6	0	8	25	0
Nigeria	81	0	0	5	2	12
Scotland	63	5	1	5	16	9
Swaziland	83	8	0	4	0	4
Sweden	13	31	0	35	19	2
Thailand	92	1	0	3	4	0
USA	43	23	1	9	23	1
POPULATION B						
Belgium (FL)	3	5	3	49	47	2
Belgium (FR)	4	10	3	39	39	5
Canada (BC)	5	0	4	21	63	8
Canada (ON)	4	1	3	5	86	1
England/Wales	1	0	3	17	77	2
Finland	0	1	0	46	51	3
Hong Kong	2	2	3	46	43	5
Hungary	22	2	11	36	27	1
Israel	2	8	3	38	39	11
Japan	80	6	6	3	2	3
New Zealand	1	15	0	24	59	0
Scotland	2	0	0	9	87	2
Sweden	0	0	0	11	89	0
Thailand	78	6	0	8	6	2
USA	9	7	3	20	60	2

Table 2.1
Teachers Reporting Calculator Use by Freqency of Use
for Population A and Population B: 1981

Country	Percent Reporting					
	Two/more period per week	One period per week	Occasionally	Never	Not allowed	N R
Population A: Four-Function Calculators						
Belgium(Fl)	0	1	8	50	39	5
Belgium(Fr)	3	4	23	66	0	5
Canada(BC)	2	0	36	22	31	8
Canada(On)	7	3	34	24	28	8
England/ Wales	5	0	33	34	19	9
Finland	0	0	18	50	25	5
France	1	0	36	43	16	8
Hong Kong	1	2	12	83	1	2
Hungary	--	--	--	--	--	100
Israel	6	5	14	0	0	77
Japan	1	0	3	86	11	1
Luxem-	3	0	31	27	24	15
Nether-	1	1	10	32	52	4
New Zea-	1	1	27	45	24	5
Nigeria	9	2	11	36	29	15
Scotland	2	0	13	23	59	3
Swaziland	4	0	4	88	0	4
Sweden	6	4	58	11	1	20
Thailand	0	0	1	71	15	13
USA	4	2	29	33	30	2
Population B:Programmable Calculators						
Belgium(Fl)	37	22	30	7	0	12
Belgium(Fr)	40	19	23	7	0	12
Canada(BC)	38	4	26	4	2	25
Canada(On)	48	9	25	4	3	19
England/ Wales	76	2	13	3	1	8
Finland	32	10	15	10	1	32
Hong Kong	18	4	46	14	0	18
Hungary	4	0	16	32	0	48
Israel	43	10	13	22	0	13
Japan	0	0	5	88	4	2
New Zea.	43	11	34	3	0	9
Scotland	54	6	22	1	0	17
Sweden	94	1	1	0	0	4
Thailand	8	0	8	27	0	56
USA	44	4	23	13	0	17

Table 2.2
Calculating Device Encouraged for Recreation
as Reported by Teachers:1981

Country	Percent Reporting Computers[1]					
	4-function Calculators[1]	Programmable Calculators[1]		All of these	None of these	NR
Population A						
Belgium(Fl)	3	1	0	1	0	96
Belgium(Fr)	8	3	0	0	0	91
Canada(BC)	42	8	10	12	0	42
Canada(On)	42	4	9	13	40	5
England/ Wales	34	10	9	8	50	1
Finland	12	5	2	3	0	82
France	14	2	1	1	7	85
Hong Kong	32	7	2	5	52	10
Hungary*	--	--	--	--	--	100
Israel	21	4	2	0	0	75
Japan	16	11	7	29	0	46
Luxem-	21	5	0	0	0	79
Nether-	3	1	0	0	0	97
New Zea-	31	8	9	10	45	54
Nigeria	33	9	0	0	0	59
Scotland	9	3	2	1	0	88
Swaziland*	--	--	--	--	--	100
Sweden	22	7	1	2	0	71
Thailand	25	17	1	11	26	59
USA	38	4	12	21	0	36
Population B						
Belgium(Fl)	3	18	0	0	0	83
Belgium(Fr)	9	22	0	0	0	77
Canada(BC)	22	34	21	12	0	37
Canada(On)	17	26	13	5	39	20
England/ Wales	9	35	28	8	36	44
Finland	6	15	10	3	0	72
Hong Kong	18	33	10	14	13	31
Hungary	28	18	5	3	57	60
Israel	10	26	5	2	0	68
Japan	8	22	19	39	0	30
New Zea.	14	37	20	8	0	44
Scotland	8	17	6	6	0	73
Sweden	0	50	38	0	0	36
Thailand	11	10	1	0	0	85
USA	20	26	20	31	0	26

*No responses recorded for teachers in these two countries.
[1]Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.

Table 2.3
Uses Encouraged for the Calculator as Reported by Teachers: 1981

Country	Percent Reporting					
	Doing Project	Recrea-tion	Doing Homework	Taking Tests	Checking Answers	Problem Solving
POPULATION A						
Belgium (FL)	1	4	4	1	13	8
Belgium (FR)	3	10	30	3	30	18
Canada (BC)	37	56	9	2	30	27
Canada (ON)	41	56	18	7	49	39
England/Wales	25	45	14	7	42	29
Finland	11	17	7	5	33	28
France	10	15	27	4	33	15
Hong Kong	29	37	8	8	34	25
Hungary*	--	--	--	--	--	--
Israel	6	25	23	10	24	11
Japan	78	50	8	6	58	52
Luxembourg	2	21	36	2	35	9
Netherlands	5	3	5	5	5	7
New Zealand	25	42	11	1	17	18
Nigeria	42	42	47	44	44	44
Scotland	7	11	10	5	15	13
Swaziland*	--	--	--	--	--	--
Sweden	18	28	11	10	37	65
Thailand	36	40	16	9	26	17
USA	42	61	20	7	48	36
POPULATION B						
Belgium (FL)	0	18	74	62	53	90
Belgium (FR)	15	23	69	69	66	73
Canada (BC)	68	53	74	40	76	93
Canada (ON)	56	42	79	74	71	84
England/Wales	49	45	85	79	82	86
Finland	17	22	68	88	72	91
Hong Kong	57	54	62	62	61	63
Hungary	13	37	70	21	84	44
Israel	16	29	82	79	68	66
Japan	85	65	26	7	64	66
New Zealand	52	46	66	57	61	84
Scotland	33	23	73	72	61	78
Sweden	46	50	87	91	74	91
Thailand	15	14	25	4	35	39
USA	74	67	77	69	80	85

*No responses recorded for teachers in these two countries.

Table 3.1
Places Where Calculators Are Used by Students:1981

Country	Percent Reporting					
	Home[1]	Math Class[1]	Other Classes[1]	All	None	No Response
Population A: Four-Function Calculator						
Belgium(Fl)	33	3	4	1	15	80
Belgium(Fr)	47	8	9	2	0	51
Canada(BC)	3	3	3	3	0	97
Canada(On)	65	29	9	7	30	3
England/ Wales	46	15	8	4	43	6
Finland	24	7	4	1	0	70
France	69	11	4	2	0	33
Hong Kong	37	6	5	2	0	60
Hungary	13	2	1	1	0	89
Israel	24	0	6	0	59	19
Japan	43	3	4	0	0	52
Luxem-	43	7	3	1	31	25
Nether-	36	7	8	3	0	60
New Zea-	43	14	8	5	52	5
Nigeria	2	1	1	0	0	97
Scotland	38	10	3	1	0	57
Swaziland*	--	--	--	--	--	100
Sweden	27	46	2	1	34	7
Thailand	28	5	4	1	0	68
USA	23	25	9	5	33	40
Population B: Programmable/Scientific						
*Belgium(Fl)	42	19	16	47	0	2
*Belgium(Fr)	34	17	18	47	0	12
Canada(BC)	59	57	55	49	0	36
Canada(On)	61	62	55	51	28	35
England/ Wales	92	90	80	77	6	5
Finland	66	66	51	48	0	31
Hong Kong	76	68	69	63	0	22
Hungary	16	8	10	5	61	21
Israel	55	0	44	0	12	22
Japan+	20(60)	5(2)	11(16)	2(3)	0(0)	73(31)
New Zea.	67	64	62	52	0	27
Scotland	73	70	62	57	0	24
Sweden	89	93	82	79	0	6
Thailand	29	16	11	5	0	60
USA	64	69	55	43	20	24

*Population B students reporting use of four-function calculator only.
+Population B students reporting greater use of four-function calculator, percentages for four-function calculator given in parentheses.
[1]All students reporting this use whether only or in combination with other categories of use except for those reporting all three.

Table 3.2
Places Where Computers Are Used by Students:1981

Country	Percent Reporting					
	Homel	Math Classl	Other Classesl	All	None	No Response
Population A: Four-Function Calculator						
Belgium(Fl)	2	0	0	0	21	91
Belgium(Fr)*	--	--	--	--	--	100
Canada(BC)*	--	--	--	--	--	100
Canada(On)	4	2	1	0	94	3
England/ Wales	3	3	2	0	85	8
Finland	2	1	1	0	0	97
France	2	1	1	0	0	97
Hong Kong	6	4	4	0	0	91
Hungary*	--	--	--	--	--	100
Israel	8	0	4	0	83	14
Japan	10	1	5	0	0	84
Luxem-*	--	--	--	--	--	100
Nether-*	--	--	--	--	--	100
New Zea-	5	4	3	1	89	5
Nigeria	2	1	0	0	0	97
Scotland	2	1	1	0	0	96
Swaziland*	--	--	--	--	--	100
Sweden	1	1	1	0	87	10
Thailand	5	1	2	0	0	93
USA	1	6	6	0	85	7
Population B						
Belgium(Fl)*	--	--	--	--	--	100
Belgium(Fr)*	--	--	--	--	--	100
Canada(BC)	3	2	7	1	0	92
Canada(On)	5	2	6	1	83	90
England/ Wales	4	2	10	0	80	9
Finland	2	1	3	0	0	95
Hong Kong	1	1	1	0	0	97
Hungary	2	1	3	0	75	21
Israel	5	0	7	0	85	10
Japan	3	1	3	0	0	93
New Zea.	3	8	13	9	0	80
Scotland*	--	--	--	--	--	100
Sweden	3	22	14	1	58	11
Thailand	2	1	2	0	0	96
USA	3	8	19	1	71	75

*No responses recorded for students in these countries.

Table 3.3
Calculating Device Used for Checking Answers by Students:1981

Country	Percent Reporting					
	4-function Calculator*	Programmable Calculator*	Computer*	All of These	None of These	No Response
Population A						
Belgium(Fl)	25	6	2	1	58	65
Belgium(Fr)	23	61	0	0	0	18
Canada(BC)	28	8	3	2	0	70
Canada(On)	32	40	10	4	45	3
England/ Wales	45	12	4	2	40	7
Finland	23	6	2	0	0	70
France	34	5	1	0	0	65
Hong Kong	30	25	22	15	0	63
Hungary	5	0	0	0	0	95
Israel	24	12	20	2	40	17
Japan	20	7	4	1	0	75
Luxem-	31	46	0	0	0	23
Nether-	31	10	0	0	0	60
New Zea-	30	7	4	3	65	6
Nigeria	3	1	0	0	0	96
Scotland	21	4	2	1	0	76
Swaziland	19	0	0	0	36	45
Sweden	29	12	1	0	0	60
Thailand	15	4	0	0	77	7
USA	34	5	2	1	41	26
Population B						
Belgium(Fl)	27	0	0	0	0	73
Belgium(Fr)	64	24	0	0	0	9
Canada(BC)	24	30	2	1	0	57
Canada(On)	36	74	69	30	15	22
England/ Wales	11	39	1	0	53	6
Finland	24	51	0	0	0	27
Hong Kong	13	12	2	1	0	80
Hungary	16	4	0	0	51	30
Israel	19	59	19	2	9	9
Japan	30	13	1	1	0	65
New Zea.	18	35	3	1	0	55
Scotland	8	18	0	0	0	75
Sweden	4	60	2	0	0	37
Thailand	29	20	0	0	42	17
USA	52	20	5	1	24	42

*Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.

Table 3.4
Calculating Device Used for Solving Problems by Students:1981

Country	Percent Reporting					
	4-function Calculator*	Programmable Calculator*	Computer*	All of These	None of These	No Response
Population A						
Belgium(Fl)	13	3	1	1	69	68
Belgium(Fr)	17	65	0	0	0	20
Canada(BC)	32	10	5	3	0	64
Canada(On)	13	26	45	5	41	3
England/ Wales	33	18	8	4	46	8
Finland	20	7	2	0	0	72
France	14	4	1	0	0	83
Hong Kong	20	14	9	5	0	74
Hungary	3	0	0	0	0	97
Israel	14	13	17	4	53	19
Japan	11	5	3	1	0	85
Luxem-	18	54	0	0	0	28
Nether-	15	9	0	0	0	77
New Zea-	30	9	5	3	64	6
Nigeria	4	2	1	0	0	95
Scotland	20	9	4	2	0	73
Swaziland	21	0	0	0	34	46
Sweden	44	21	1	0	0	36
Thailand	11	4	0	0	79	7
USA	38	8	4	1	35	27
Population B						
Belgium(Fl)	58	0	0	0	0	42
Belgium(Fr)	74	21	0	0	0	7
Canada(BC)	40	76	8	4	0	7
Canada(On)	51	20	72	14	16	23
England/ Wales	14	91	7	2	3	4
Finland	29	69	0	0	0	5
Hong Kong	60	75	6	5	0	7
Hungary	33	13	2	0	31	24
Israel	15	59	17	2	13	9
Japan	26	12	1	0	0	68
New Zea.	30	78	15	3	0	9
Scotland	17	70	2	0	0	15
Sweden	3	94	11	1	0	6
Thailand	26	22	0	0	44	17
USA	68	34	13	6	3	21

*Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.

Table 3.5
Calculating Device Used in Taking Tests by Students:1981

Country	Percent Reporting					
	4-function Calculator*	Programmable Calculator*	Computer*	All of These	None of These	No Response
Population A						
Belgium(Fl)	2	1	1	0	80	67
Belgium(Fr)	4	76	0	0	0	21
Canada(BC)	3	2	1	0	0	95
Canada(On)	2	3	0	0	96	3
England/ Wales	5	7	4	1	77	9
Finland	13	5	3	0	0	80
France	5	2	1	0	0	94
Hong Kong	5	4	3	1	0	91
Hungary	1	0	0	0	0	99
Israel	9	8	11	4	65	22
Japan	3	3	2	0	0	94
Luxem-	2	66	0	0	0	32
Nether-	7	6	0	0	0	88
New Zea-	4	2	2	1	92	6
Nigeria	3	2	1	0	0	96
Scotland	4	4	2	1	0	92
Swaziland	21	0	0	0	33	46
Sweden	14	7	1	0	0	78
Thailand	4	2	0	0	88	8
USA	9	2	1	0	65	27
Population B						
Belgium(Fl)	52	0	0	0	0	48
Belgium(Fr)	73	22	0	0	0	7
Canada(BC)	26	63	1	1	0	24
Canada(On)	11	22	17	8	69	76
England/ Wales	9	83	1	0	11	5
Finland	29	70	0	0	0	3
Hong Kong	57	76	2	1	0	4
Hungary	5	2	0	0	61	33
Israel	13	65	19	2	9	8
Japan	2	2	0	0	0	97
New Zea.	16	59	2	0	0	32
Scotland	14	61	1	0	0	25
Sweden	2	93	1	0	0	6
Thailand	3	3	0	0	71	25
USA	58	27	2	1	12	30

*Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.

Table 3.6
Calculating Device Used in Doing Projects by Students:1981

Country	Percent Reporting					
	4-function Calculator*	Programmable Calculator*	Computer*	All of These	None of These	No Response
Population A						
Belgium(Fl)	7	3	1	0	74	67
Belgium(Fr)1	--	--	--	--	--	100
Canada(BC)	18	8	5	2	0	77
Canada(On)	2	4	3	0	94	3
England/ Wales	13	8	6	2	69	9
Finland	13	6	3	0	0	79
France1	--	--	--	--	--	100
Hong Kong	10	8	4	1	0	85
Hungary1	--	--	--	--	--	100
Israel	20	19	21	6	44	19
Japan	7	6	6	1	0	86
Luxem-1	--	--	--	--	--	100
Nether-	12	10	0	0	0	79
New Zea-	14	6	5	2	49	6
Nigeria	3	1	1	0	0	96
Scotland	7	4	4	1	0	88
Swaziland	18	0	0	0	36	46
Sweden	8	6	2	0	0	85
Thailand	9	5	0	0	82	8
USA	18	5	5	1	53	27
Population B						
Belgium(Fl)1	--	--	--	--	--	100
Belgium(Fr)1	--	--	--	--	--	100
Canada(BC)	23	48	11	4	0	39
Canada(On)	14	12	19	7	70	77
England/ Wales	6	43	8	1	49	6
Finland	22	48	2	0	0	31
Hong Kong	49	65	2	1	0	18
Hungary1	--	--	--	--	--	100
Israel	16	63	19	5	11	11
Japan	2	2	1	0	0	97
New Zea.	19	52	17	3	0	36
Scotland	4	19	4	0	0	76
Sweden	2	67	12	0	0	30
Thailand	14	11	0	0	57	22
USA	39	21	19	5	30	48

*Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.
1No responses recorded from students in these countries.

Table 3.7
Calculating Device Used for Recreation by Students:1981

Country	Percent Reporting					
	4-function Calculator*	Programmable Calculator*	Computer*	All of These	None of These	No Response
Population A						
Belgium(Fl)	20	7	3	2	61	66
Belgium(Fr)	16	66	0	0	0	20
Canada(BC)	30	12	11	4	0	62
Canada(On)	3	3	0	0	95	3
England/ Wales	14	9	6	2	66	10
Finland	22	5	3	0	0	70
France	11	2	1	0	0	87
Hong Kong	33	14	11	4	0	61
Hungary	1	0	0	0	0	99
Israel	25	23	27	8	34	19
Japan	12	6	7	1	0	80
Luxem-	12	58	0	0	0	30
Nether-	18	7	0	0	0	76
New Zea-	34	13	11	4	55	6
Nigeria	4	2	1	0	0	95
Scotland	8	4	4	1	0	87
Swaziland	14	0	0	0	39	47
Sweden	23	15	2	0	0	62
Thailand	5	3	0	0	86	8
USA	24	7	14	3	43	27
Population B						
Belgium(Fl)	11	0	0	0	0	89
Belgium(Fr)	23	63	0	0	0	15
Canada(BC)	11	24	14	2	0	63
Canada(On)	2	6	1	0	87	93
England/ Wales	4	22	16	1	64	6
Finland	27	56	8	1	0	18
Hong Kong	39	57	11	4	0	24
Hungary	2	0	0	0	65	33
Israel	22	52	19	9	24	12
Japan	16	11	6	1	0	75
New Zea.	8	27	21	2	0	58
Scotland	1	1	5	0	0	93
Sweden	3	59	24	1	0	30
Thailand	12	9	0	0	60	23
USA	19	14	26	3	41	59

*Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.

Table 3.8
Calculating Device Used for Doing Homework by Students:1981

Country	Percent Reporting					
	4-function Calculator*	Programmable Calculator*	Computer*	All of These	None of These	No Response
Population A						
Belgium(Fl)	32	8	1	1	50	66
Belgium(Fr)	38	51	0	0	0	12
Canada(BC)	34	10	3	2	0	62
Canada(On)	3	9	2	0	88	3
England/ Wales	35	14	3	2	47	8
Finland	28	6	2	0	0	64
France	64	9	1	0	0	31
Hong Kong	18	6	3	1	0	79
Hungary	10	0	0	0	0	90
Israel	16	12	15	4	53	20
Japan	19	6	3	1	0	77
Luxem-	42	47	0	0	0	11
Nether-	25	10	0	0	0	66
New Zea-	33	8	4	3	62	6
Nigeria	5	2	2	0	0	93
Scotland	25	7	2	1	0	70
Swaziland	22	0	0	0	31	47
Sweden	25	15	1	0	0	61
Thailand	19	6	0	0	66	13
USA	40	9	3	1	32	27
Population B						
Belgium(Fl)	80	17	1	0	0	3
Belgium(Fr)	74	25	0	0	0	3
Canada(BC)	43	74	3	2	0	8
Canada(On)	8	15	3	2	76	82
England/ Wales	16	91	2	0	2	5
Finland	32	70	1	0	0	4
Hong Kong	60	77	1	1	0	3
Hungary	39	15	1	0	24	23
Israel	14	63	19	2	10	8
Japan	42	15	1	0	0	53
New Zea.	36	74	3	1	0	9
Scotland	19	70	0	0	0	14
Sweden	5	91	1	0	0	8
Thailand	30	22	0	0	40	16
USA	68	31	5	2	4	23

*Obtained by adding together percentages responding to use of that type only and in combination with one of the other two types but not including all.

Table 3.9
Uses Made of the Calculator by Students:1981

Country	Percent Reporting*					
	Checking Answers	Problem Solving	Taking Tests	Doing Projects	Recrea-tion	No Response
Population A						
Belgium(Fl)	28	14	3	8	22	36
Belgium(Fr)	83	81	80	0	81	89
Canada(BC)	31	37	5	22	35	39
Canada(On)	54	33	4	5	4	11
England/ Wales	51	43	11	18	20	43
Finland	28	26	17	18	27	34
France	37	18	6	0	13	73
Hong Kong	35	25	8	13	36	21
Hungary	5	3	1	0	1	10
Israel	31	21	11	27	34	21
Japan	24	14	5	10	15	23
Luxem-	77	72	68	0	70	89
Nether-	40	23	12	21	24	34
New Zea-	32	33	5	16	40	35
Nigeria	4	5	4	4	5	6
Scotland	23	26	7	10	11	29
Swaziland	19	21	21	18	14	22
Sweden	39	63	21	14	36	38
Thailand	17	14	5	11	37	21
USA	35	40	9	20	26	42
Population B						
Belgium(Fl)	27	58	52	0	11	97
Belgium(Fr)	93	95	94	0	86	99
Canada(BC)	43	93	76	58	30	93
Canada(On)	77	56	23	19	7	17
England/ Wales	44	96	87	46	24	97
Finland	73	95	97	68	78	96
Hong Kong	20	93	96	82	69	97
Hungary	19	44	6	0	2	52
Israel	71	67	71	67	59	70
Japan	35	31	3	3	22	47
New Zea.	45	92	69	63	31	93
Scotland	25	85	74	22	2	86
Sweden	62	94	94	67	60	92
Thailand	41	39	5	20	17	44
USA	58	79	70	48	27	77

*Percent reported is the combined percentage of students reporting either using a four-function calculator or a scientific/programmable calculator.

Table 3.10
Student Agreement With Opinions About Using Calculators:1981

Country	Percent Reporting							
	Agree or Strongly Agree				Disagree or Strongly Disagree			
	*A1	*A2	A3	A4	*A1	*A2	A3	A4
Population A								
Belgium(Fl)	29	44	38	48	33	36	25	29
Belgium(Fr)	44	53	18	52	23	21	46	14
Canada(BC)	35	30	31	30	34	44	35	35
Canada(On)	70	61	19	54	12	13	51	21
England/1 Wales	29	--	42	48	49	--	31	37
Finland	41	25	45	25	27	54	21	36
France	30	19	37	39	39	75	23	34
Hong Kong	39	27	32	23	28	38	28	43
Hungary	55	34	34	29	16	24	34	32
Israel	53	47	28	35	27	25	49	33
Japan	14	27	38	13	42	45	14	42
Luxem-	41	57	15	46	26	19	51	20
Nether-	45	14	36	41	23	78	31	35
New Zea-	37	38	34	46	41	55	30	36
Nigeria	28	22	32	39	47	40	50	36
Scotland	32	27	34	24	44	59	40	42
Swaziland1	--	--	--	--	--	--	--	--
Sweden	44	32	27	41	29	52	38	31
Thailand	22	11	28	37	44	75	42	45
USA	34	16	33	43	35	63	31	33
Population B								
Belgium(Fl)	85	49	28	32	7	25	25	34
Belgium(Fr)	86	49	47	42	9	27	24	29
Canada(BC)	71	60	34	29	18	20	31	45
Canada(On)	43	58	44	38	14	8	14	18
England/1 Wales	--	--	--	43	--	--	--	35
Finland	91	41	27	23	6	32	27	50
Hong Kong	52	49	48	71	29	21	27	13
Hungary	94	22	16	35	3	36	45	32
Israel	38	51	35	52	40	24	38	26
Japan	76	25	11	42	10	29	40	23
New Zea.	79	44	12	31	15	32	35	41
Scotland	83	50	42	43	13	32	32	32
Sweden	87	71	48	25	10	16	17	51
Thailand	68	51	26	24	24	33	53	46
USA	83	48	41	27	8	19	32	42

1No responses were given by students in these countries to these items.
*Indicates a negatively oriented-item(agreement indicates disagreement)
A1 It is less fun to learn math. ideas if you use a hand-held calculator.
A2 If you use a hand-held calculator you do not have to learn to compute.
A3 Using a hand-held calculator can help you learn many different math.topics.
A4 Solving word Problems is more fun if you use a hand-held calculator.

Table 3.11
Median Polish: Student Agreement With Opinions About Using Calculators

Country	Residuals (agree or strongly agree) *A1	*A2	A3	A4	Row Effects	Residuals (disagree) *A1	*A2	A3	A4	Row Effects
Population A										
Belgium(Fl)	--	--	--	--	--	--	--	--	--	--
Belgium(Fr)	--	--	-27	--	12	--	--	30	--	-15
Canada(BC)	--	--	--	--	--	--	--	--	--	--
Canada(Ont)	--	--	-37	--	23	--	--	37	--	-17
Finland	--	--	--	--	--	--	--	--	--	--
France	--	--	--	--	--	--	30	--	--	--
Hong Kong	--	--	--	--	--	--	--	--	--	--
Hungary	18	--	--	--	--	--	--	--	--	--
Israel	--	--	--	--	--	--	--	21	--	--
Japan	--	--	18	--	--	--	--	-23	--	--
Luxem.	--	17	-25	--	--	--	--	30	--	--
Nether.	--	-21	--	--	--	--	36	--	--	--
Nigeria	--	--	--	--	--	--	--	--	--	--
New Zea.	--	--	--	--	--	--	--	--	--	--
Scotland	--	--	--	--	--	--	--	--	--	--
Sweden	--	--	--	--	--	--	--	--	--	--
Thailand	--	--	--	--	--	--	22	--	--	--
USA	--	--	--	--	--	--	21	--	--	--
Column Effects	--	--	--	--	34 Total	--	--	--	--	34 Total
Population B										
Belgium(Fl)	--	--	--	--	--	--	--	--	--	--
Belgium(Fr)	--	--	--	--	--	--	--	--	--	--
Canada(BC)	--	--	--	--	--	--	--	--	--	--
Canada(Ont)	-41	--	--	--	--	18	--	--	--	-16
Finland	19	--	--	--	--	--	--	--	15	--
Hong Kong	-33	--	--	29	--	22	--	--	-16	--
Hungary	24	-17	--	--	--	--	--	--	--	--
Israel	-42	--	--	15	--	26	--	--	--	--
Japan	--	--	--	20	--	--	--	--	--	--
New Zea.	--	--	-19	--	--	--	--	--	--	--
Scotland	--	--	--	--	--	--	--	--	--	--
Sweden	--	--	--	-20	--	--	--	--	23	--
Thailand	--	--	--	--	--	--	--	--	--	--
USA	--	--	--	--	--	--	--	--	--	--
Column Effects	36	--	--	--	42 Total	-17	--	--	--	29 Total

Table 3.12
Student Agreement With Opinions About Using Computers:1981

Country	Percent Reporting Agree or Strongly Agree				Disagree or Strongly Disagree			
	B1	*B2	B3	B4	B1	*B2	B3	B4
Population A								
Belgium(Fl)	36	22	39	40	26	29	28	21
Belgium(Fr)	50	40	23	--	27	30	62	--
Canada(BC)	47	39	69	72	26	28	10	7
Canada(On)	20	54	88	--	59	15	4	--
England/1 Wales	--	--	--	--	--	--	--	--
Finland	38	19	45	57	22	38	19	11
France	42	36	34	80	26	22	24	6
Hong Kong	33	39	18	--	31	27	56	--
Hungary	41	32	5	--	29	38	88	--
Israel	39	43	13	--	33	29	74	--
Japan	41	13	21	34	17	34	23	17
Luxem-	56	29	21	--	21	50	65	--
Nether-	35	25	24	36	30	31	46	24
New Zea-	42	44	58	54	25	26	15	15
Nigeria	57	31	48	--	27	50	31	--
Scotland	60	31	49	64	21	39	26	14
Swazilandl	--	--	--	--	--	--	--	--
Sweden	52	13	42	54	16	50	20	12
Thailand	27	23	72	54	35	47	9	13
USA	40	54	61	71	29	20	13	8
Population B								
Belgium(Fl)	26	24	47	46	33	53	18	18
Belgium(Fr)	22	9	87	80	38	76	6	5
Canada(BC)	19	7	80	77	53	78	4	4
Canada(On)	29	8	80	17	27	64	6	4
England/1 Wales	--	--	33	32	--	--	42	40
Finland	23	18	79	76	45	68	7	7
Hong Kong	31	92	48	--	51	5	35	--
Hungary	26	8	91	91	40	64	2	2
Israel	27	93	56	--	50	4	26	--
Japan	30	14	58	57	20	47	7	7
New Zea.	18	11	71	69	51	71	7	7
Scotland	25	21	76	73	47	61	8	8
Sweden	26	10	81	75	40	73	7	6
Thailand	56	4	77	75	20	89	6	5
USA	9	7	84	82	68	76	4	4

1No responses were given by students in these countries to these items.
*Indicates a negatively oriented-item(agreement indicates disagreement)
B1 Computers solve problems better than people do.
*B2 Using computers makes learning mathematics mechanical and boring.
B3 Everyone should learn something about computers.
B4 Computers do lots of good things for people.

Table 3.13
Median Polish: Student Agreement With Opinions About Using Computers

Country	Residuals (agree or strongly agree) *B	*B2	B3	B4	Row Effects	Residuals (disagree) *B1	*B2	B3	B4	Row Effects
Population A										
Belgium(Fl)	--	--	--	--	--	--	--	--	--	--
Canada(BC)	--	--	--	--	16	--	--	--	--	--
Finland	--	--	--	--	--	--	--	--	--	--
France	--	--	--	21	--	--	--	--	--	--
Japan	18	--	--	--	-16	--	--	--	--	--
Nether.	--	--	--	--	--	--	--	15	--	--
New Zea.	--	--	--	--	--	--	--	--	--	--
Scotland	--	--	--	--	--	--	--	--	--	--
Sweden	--	--	--	--	--	--	19	--	--	--
Thailand	--	--	30	--	--	--	--	-18	--	--
USA	-17	--	--	--	18	--	--	--	--	--
Column Effects	--	-15	--	--	42 Total	--	--	--	--	21 Total
Population B										
Belgium(Fl)	15	27	-18	-15	--	--	-16	--	--	--
Belgium(Fr)	--	--	--	--	--	--	--	--	--	--
Canada(BC)	--	--	--	--	--	--	--	--	--	--
Canada(Ont)	--	--	--	-55	--	--	--	--	--	--
Finland	--	--	--	--	--	--	--	--	--	--
Hungary	--	--	--	--	--	--	--	--	--	--
Japan	--	--	--	--	--	--	--	--	--	--
New Zea.	--	--	--	--	--	--	--	--	--	--
Scotland	--	--	--	--	--	--	--	--	--	--
Sweden	--	--	--	--	--	--	--	--	--	--
Thailand	32	--	--	--		-20	21	--	--	--
USA	--	--	--	--	--	22	--	--	--	--
Column Effects	-25	-39	29	25	48 Total	17	43	-17	-18	24 Total

Table 3.14
Attitudes About Using a Hand-held Calculator as Reported by Population B Students: 1981

Country	Percent Reporting			Percent Reporting		
	Dislike	Hard	Not Important	Like	Easy	Important
Belgium(Fl)	9	11	14	73	75	67
Belgium(Fr)	8	11	15	63	70	65
Canada(BC)	2	0	17	87	96	70
Canada(Ont)	3	1	10	75	85	68
England/ Wales	3	0	18	78	93	62
Finland	2	2	8	89	93	84
Hong Kong	5	1	7	86	91	81
Hungary	12	0	65	71	94	21
Israel	8	1	16	75	91	66
Japan	11	4	33	43	67	23
New Zea.	4	2	20	78	90	59
Scotland	4	1	26	80	94	57
Sweden	3	1	12	81	92	75
Thailand	32	4	53	55	84	39
USA	3	1	9	85	94	79

Each category represents both dislike and dislike alot, or hard and very hard or not important and not at all important or like and like alot, or easy and very easy or important and very important.

Table 3.15
Median Polish: Attitudes About Using a Hand-held Calculator as Reported by Population B Students: 1981

Country	Residuals (negative attitudes) D	H	NI	Row Effects	Residuals (positive attidudes) L	E	I	Row Effects
Belgium (Flemish)	--	--	--	--	--	--	--	--
Belgium (French)	--	--	--	--	--	--	--	-15
Canada,B.C.	--	--	--	--	--	--	--	--
Canada, Ontario	--	--	--	--	--	--	--	--
England/ Wales	--	--	--	--	--	--	--	--
Finland	--	--	--	--	--	--	--	--
Hong Kong	--	--	--	--	--	--	--	--
Hungary	--	--	44	--	--	--	-41	--
Israel	--	--	--	--	--	--	--	--
Japan	--	--	--	--	--	--	--	-35
New Zea- land	--	--	--	--	--	--	--	--
Scotland	--	--	--	--	--	--	--	--
Sweden	--	--	--	--	--	--	--	--
Thailand	--	-25	--	28	--	18	--	-23
USA	--	--	--	--	--	--	--	--
Column Effects	--	--	--	4 Total	--	--	--	78 Total

D=dislike,H=hard,NI=not important, L=like,E=easy,I=important

Figure 1.1 Four-function Calculators: Mathematics Department Policy on Their Use for Population A
as Reported by Department Heads: 1981

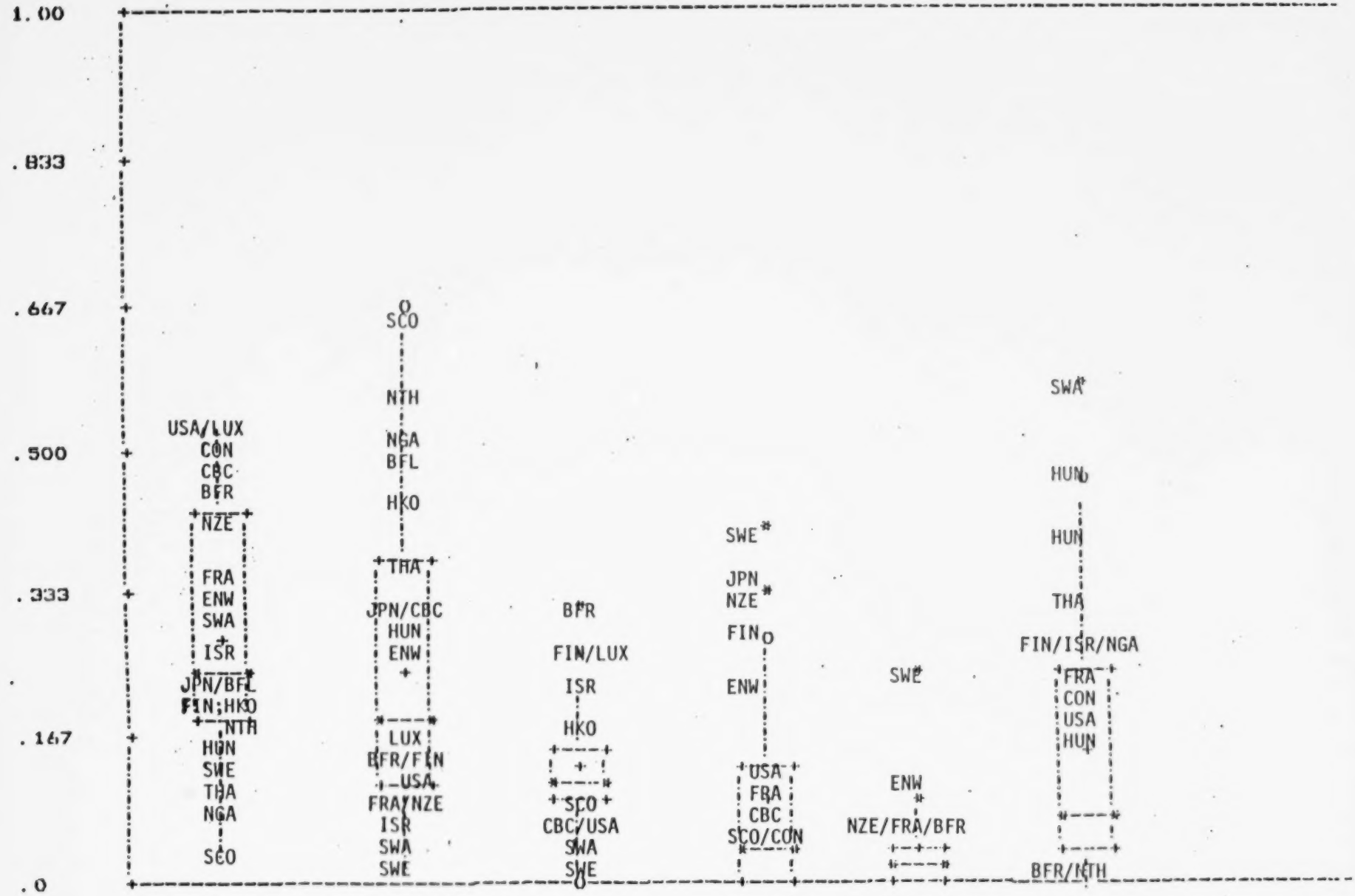


Figure 1.2 Programmable Calculators: Mathematics Department Policy on Their Use for Population A, as Reported by Department Heads: 1981

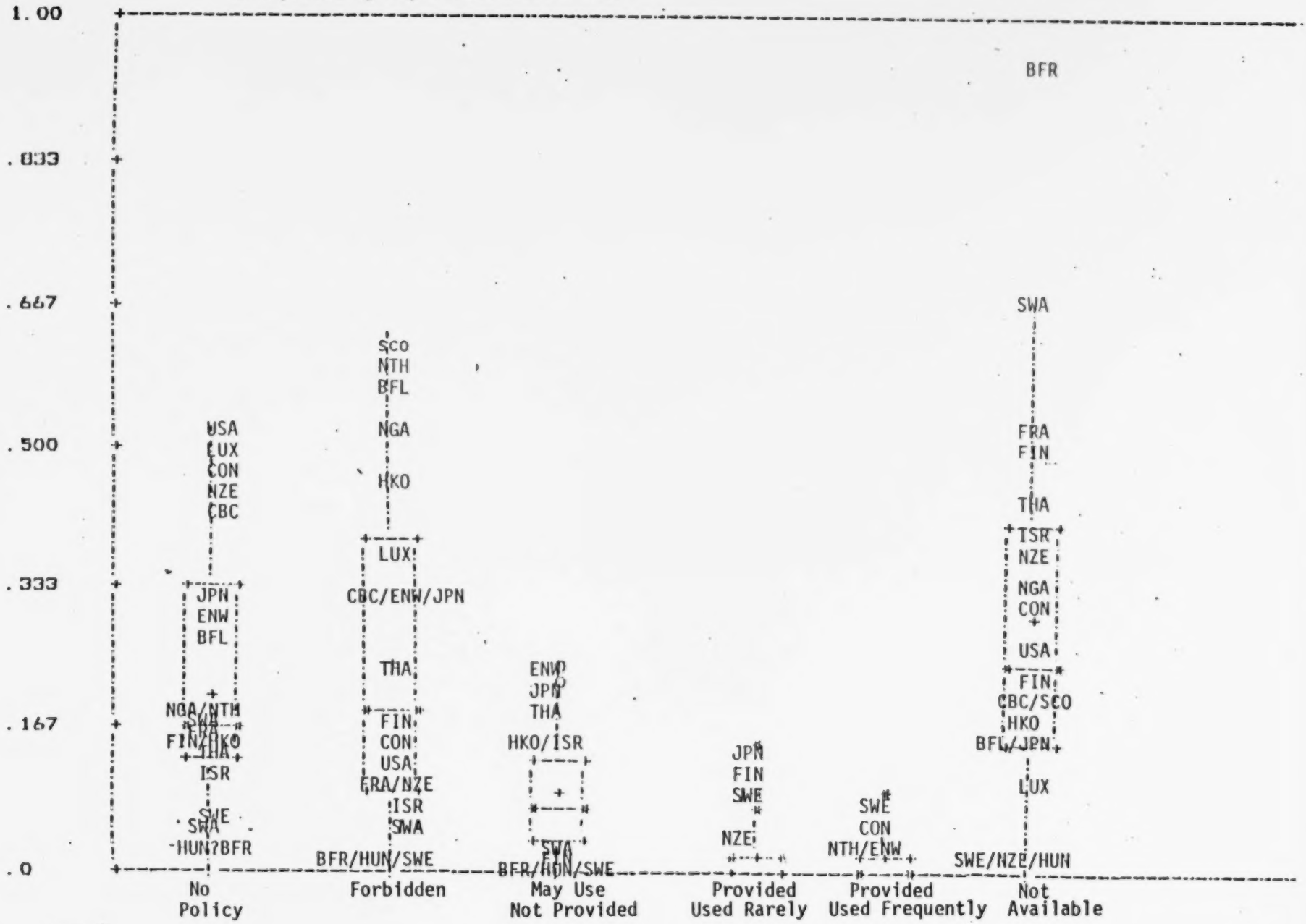


Figure 1.3 Four-function Calculators: Mathematics Department Policy on Their Use for Population,B as Reported by Department Heads: 1981

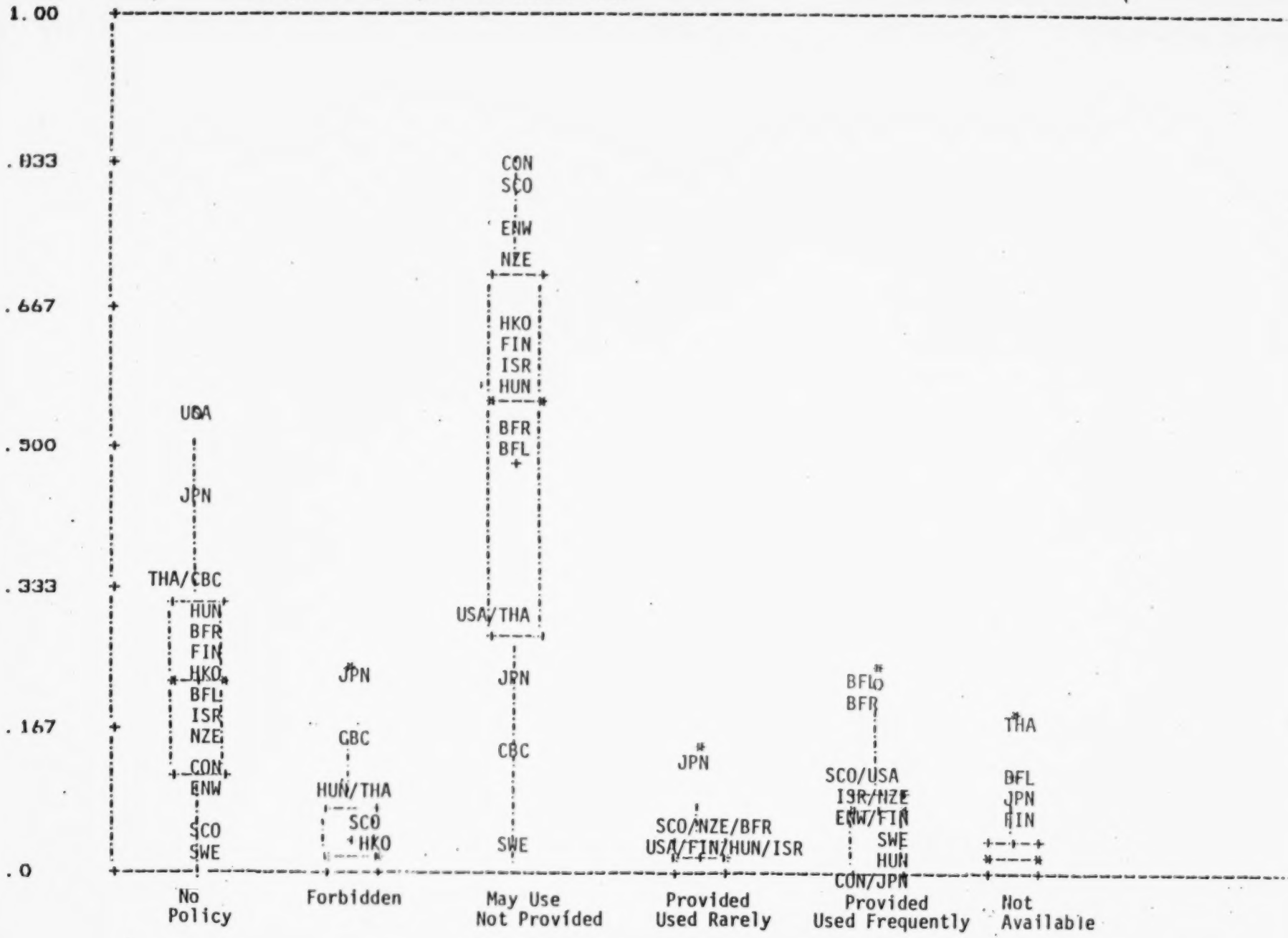


Figure 1.4 Programmalbe Calculators: Mathematics Department Policy on Their Use with Population B as Reported by Department Heads: 1981

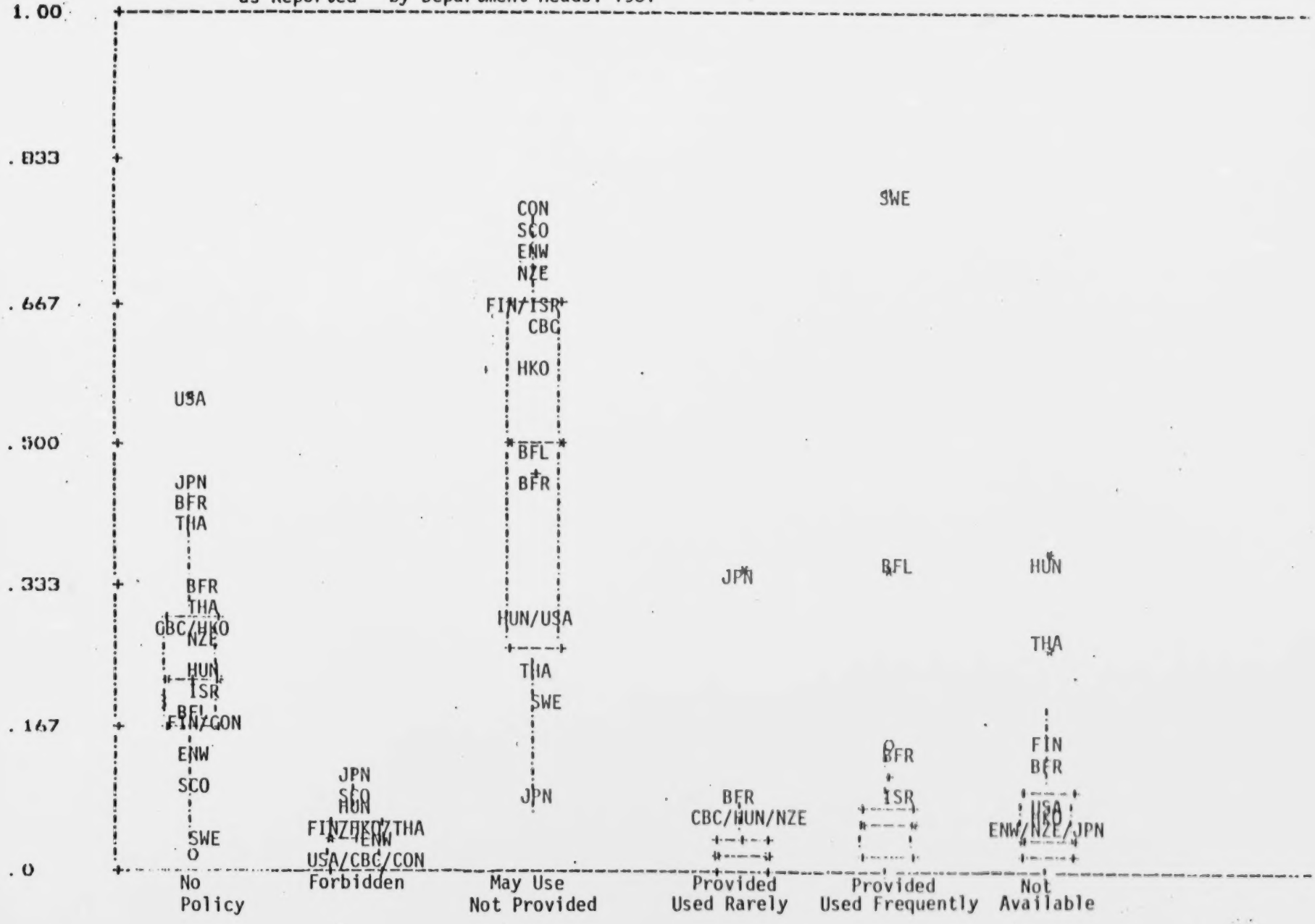


Figure 1.5 Subjects in Which Calculator Use is Encouraged in Population A as Reported by Department Heads: 1981

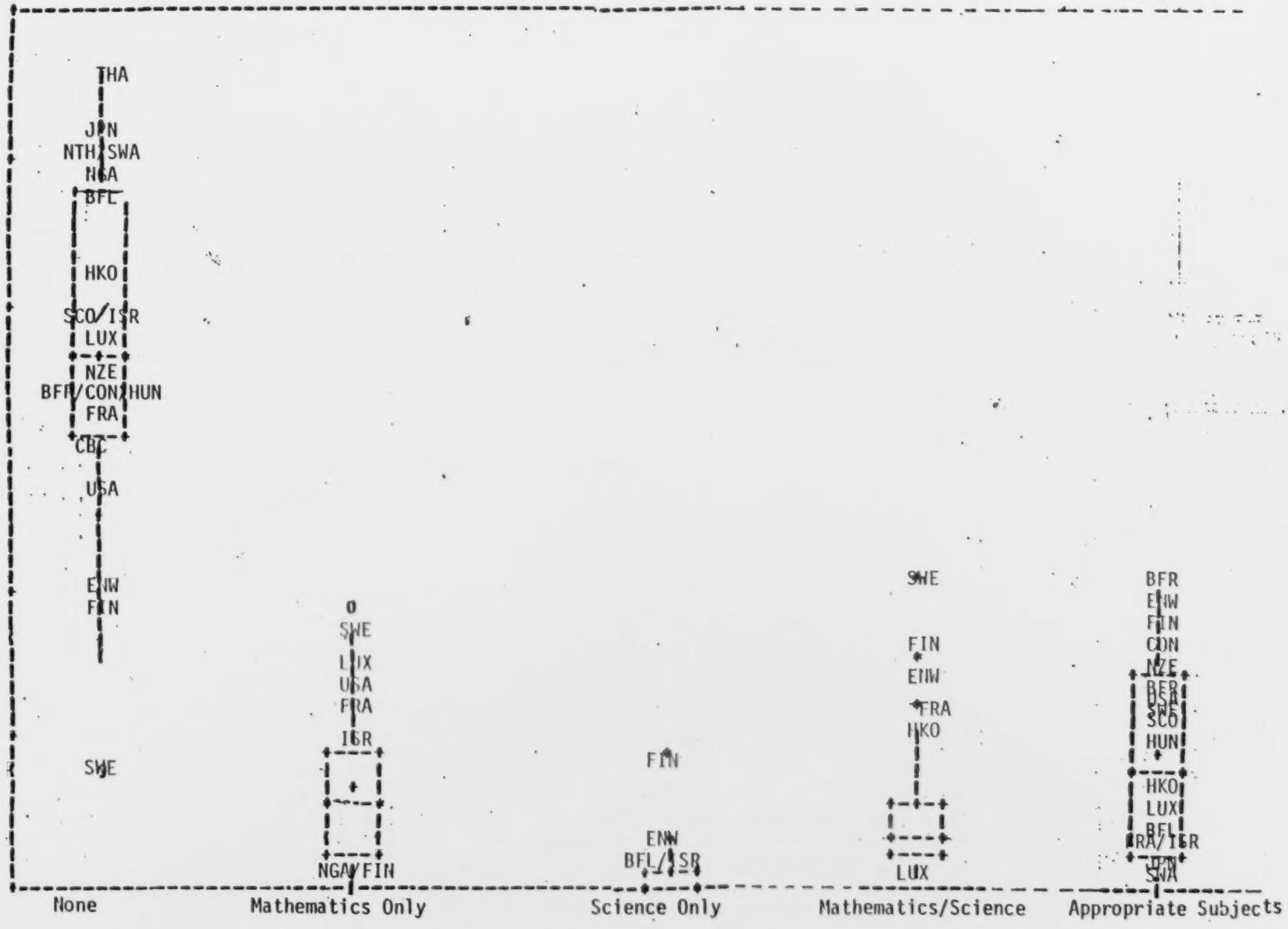


Figure 1.6 . Subjects in Which Calculator Use is Encouraged in Population B as Reported by Department Heads: 1981

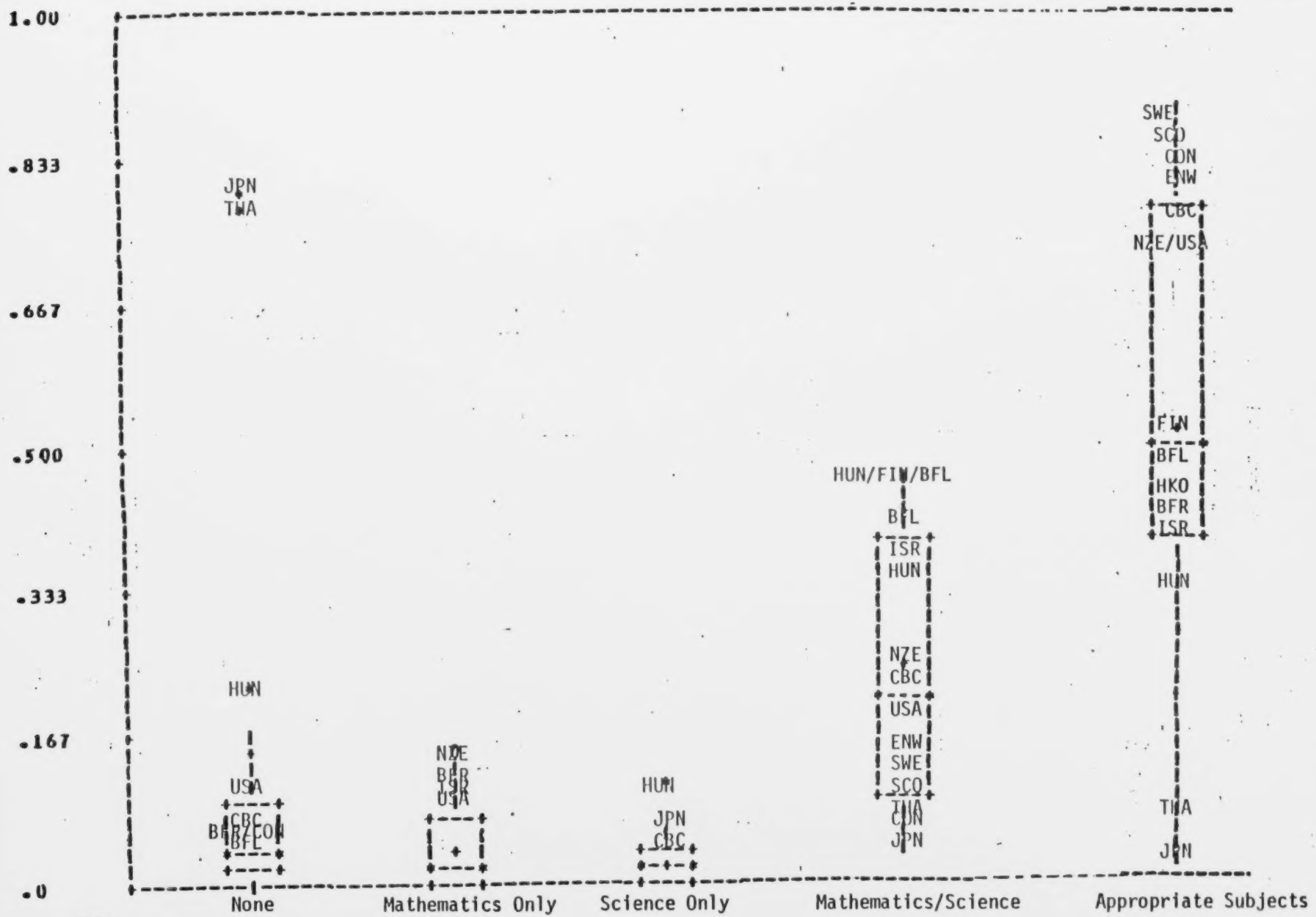


Figure 2.1 Teachers Reporting Four-function Calculator Use by Frequency of Use for Population A: 1981

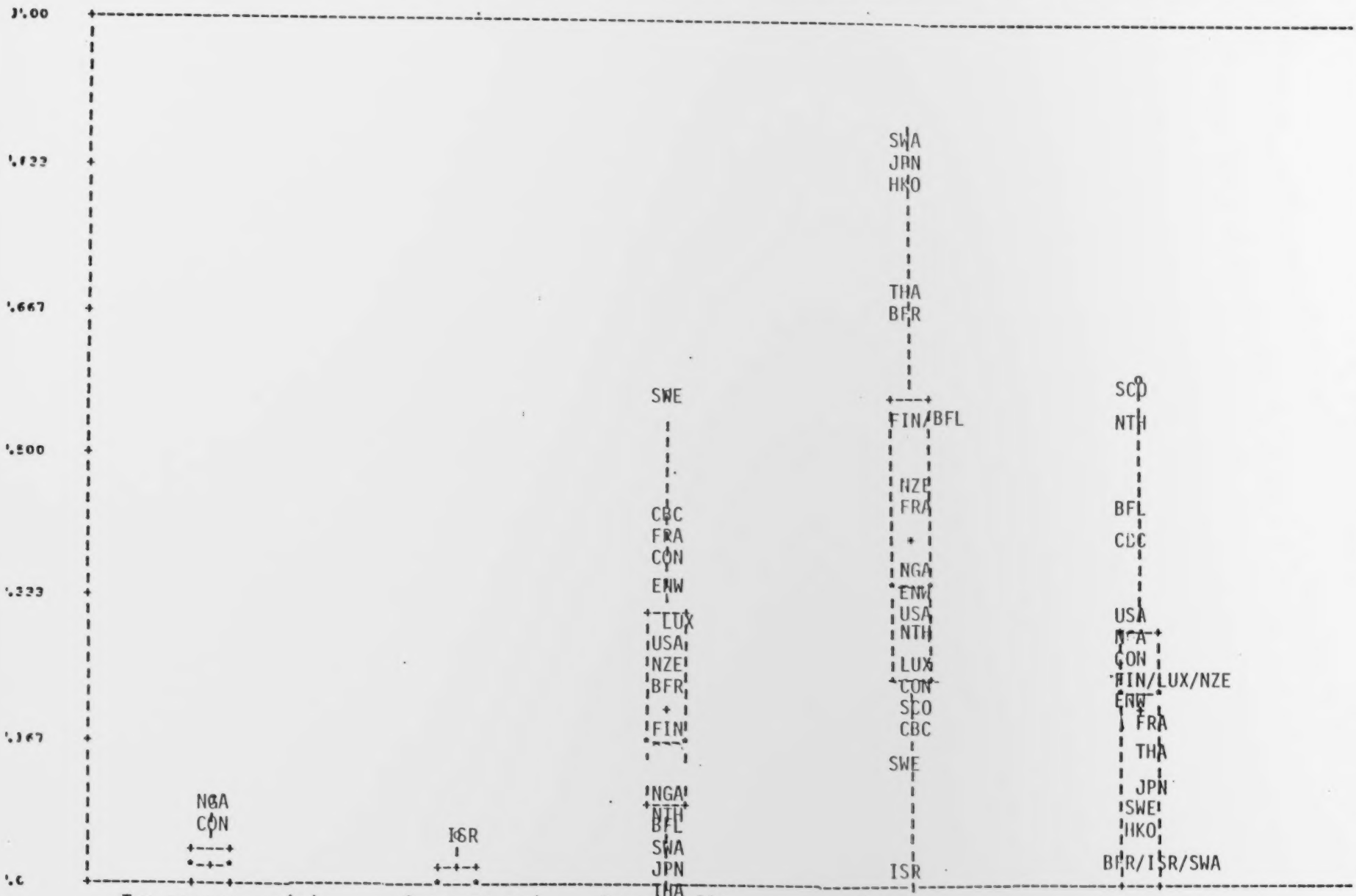


Figure 2.2 Teachers Reporting Programmable Calculator Use by Frequency of Use for Population B: 1981

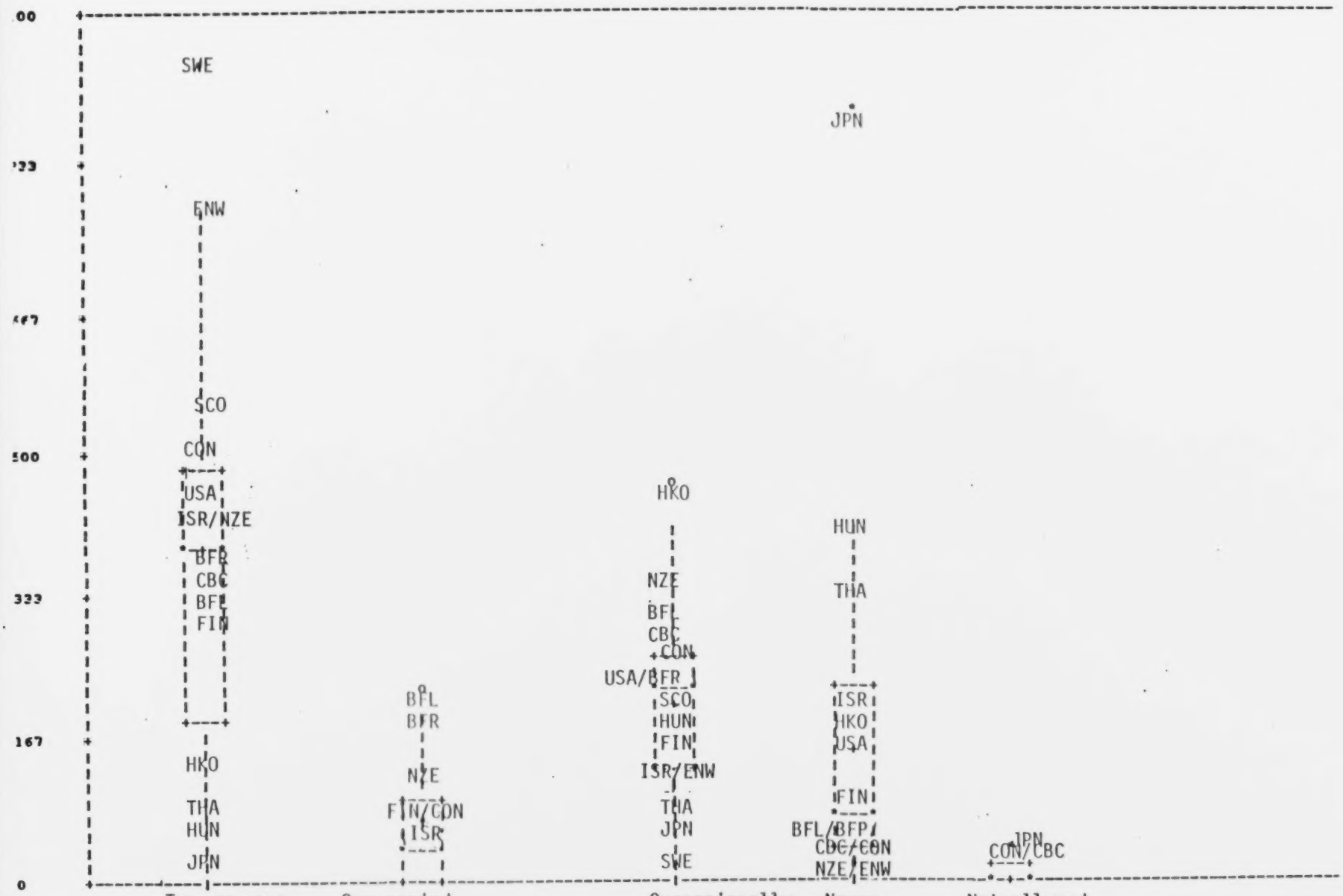


Figure 2.3 Calculating Devices Encouraged for Recreation: (Population A) 1981

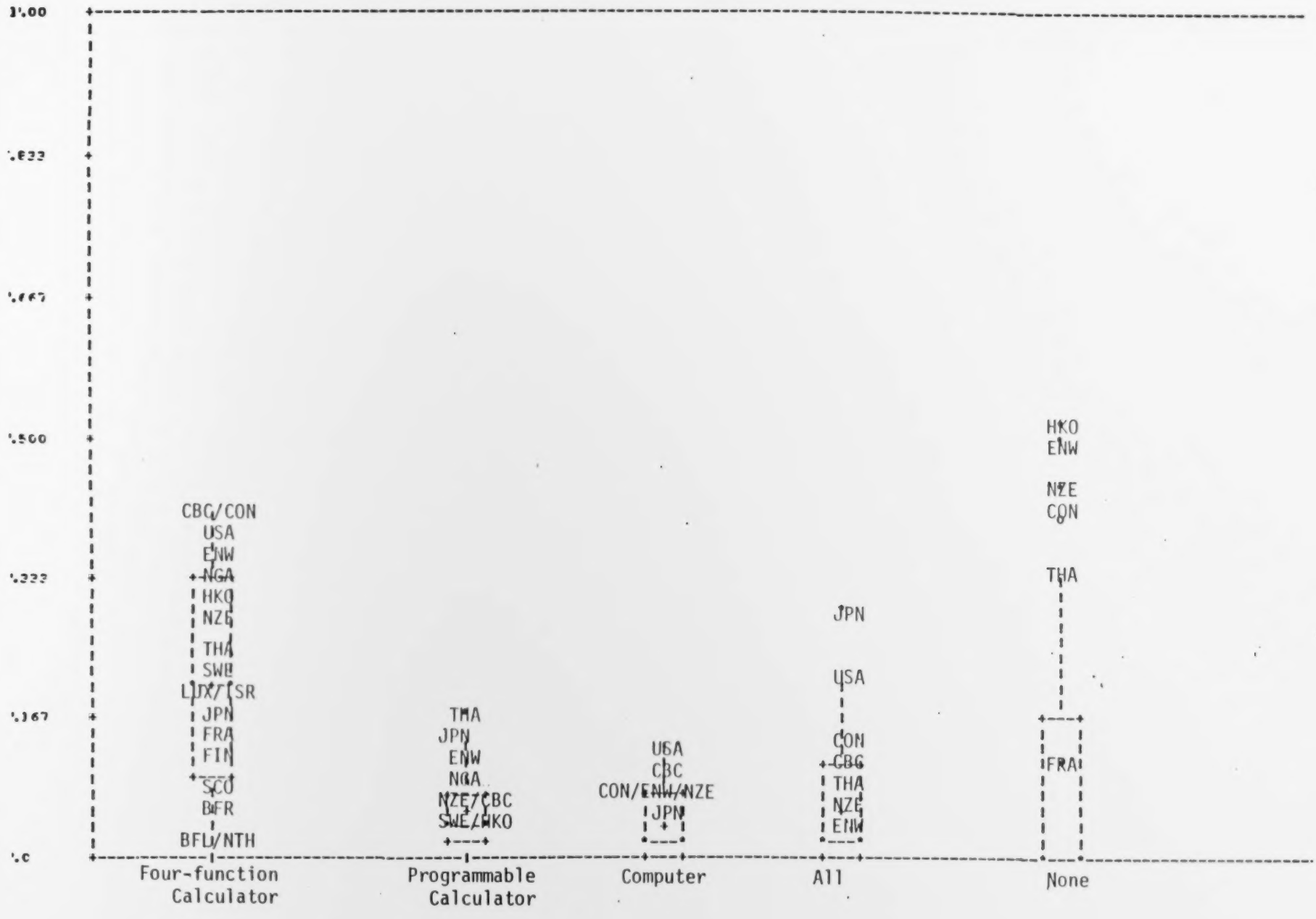


Figure 2.4 Calculating Device Encouraged for Recreation: (Population B) 1981

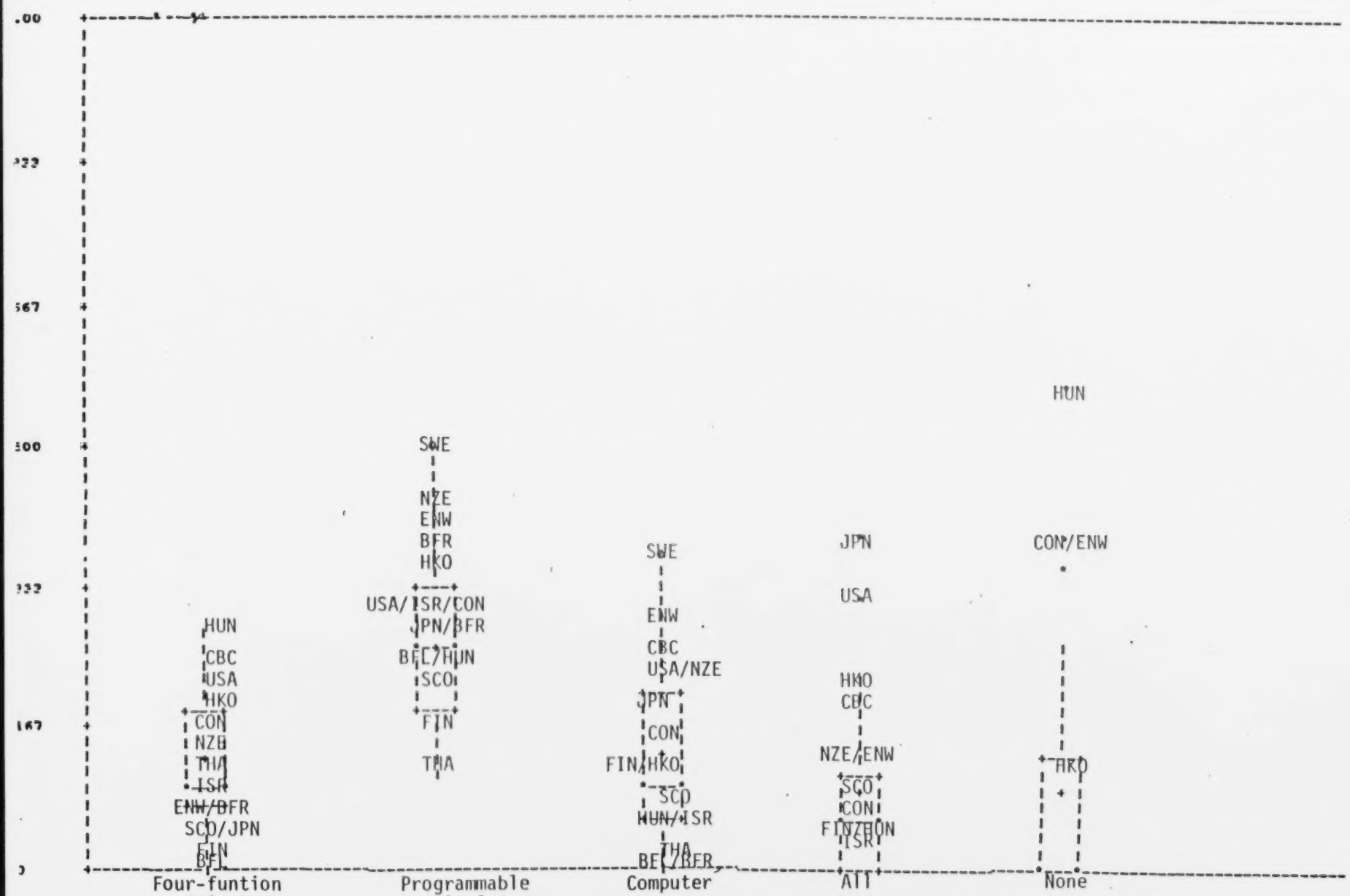


Figure 2.5 Uses Encouraged for the Calculator: (Population A) 1981

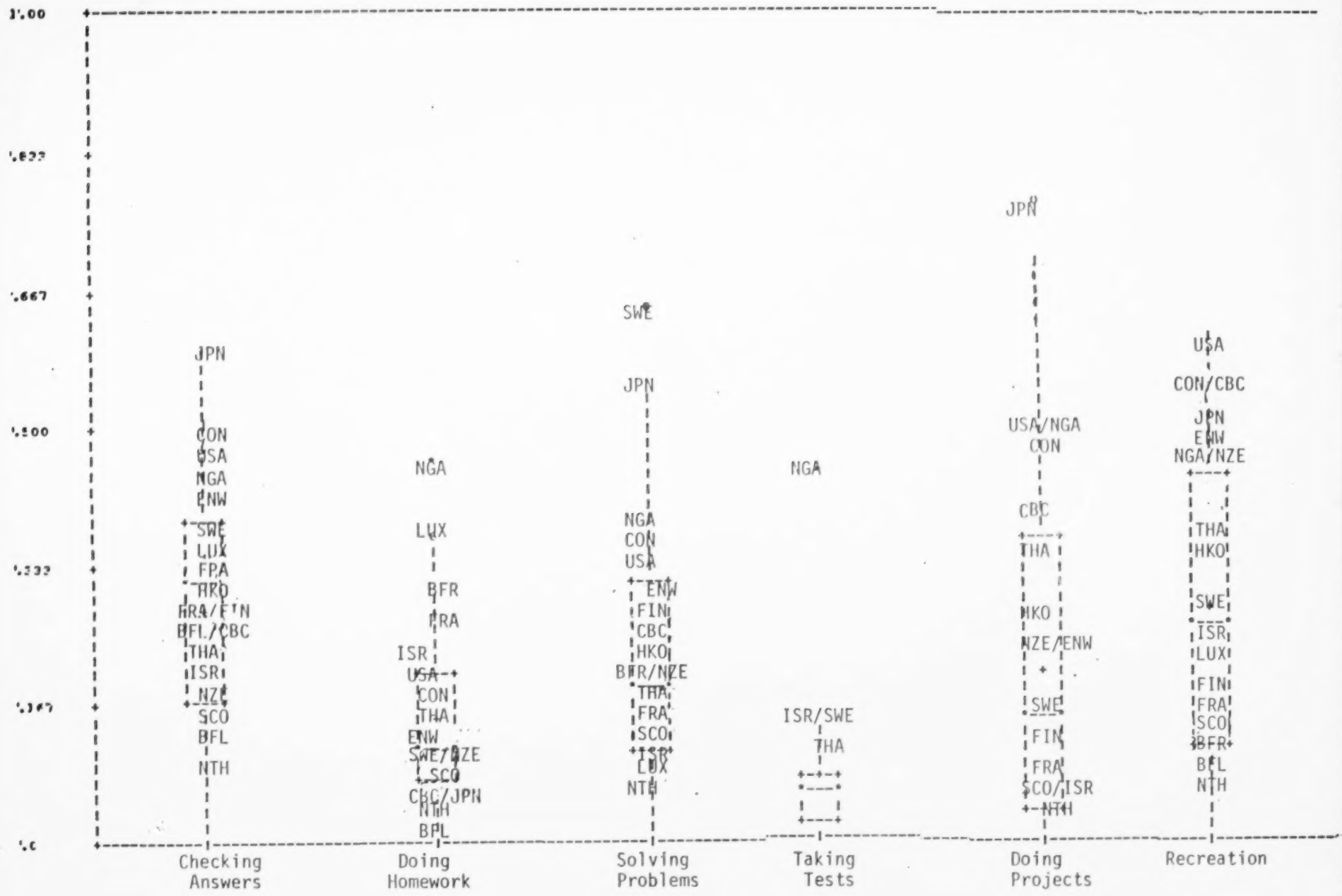


Figure 2.6 Uses Encouraged for the Calculator: (Population B) 1981

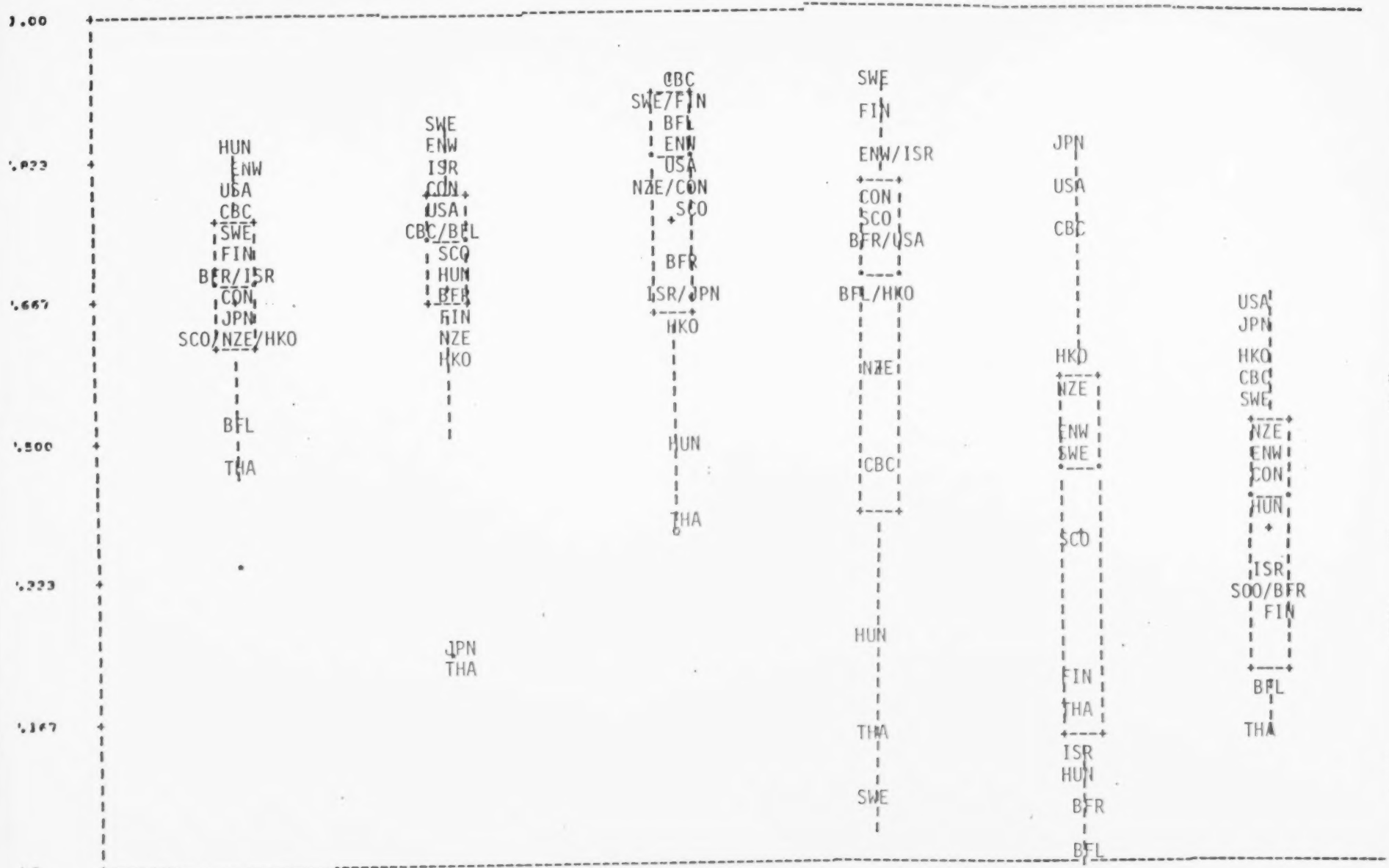


Figure 3.1 Where Four-Function Calculators Are Used by Students: (Population A) 1981

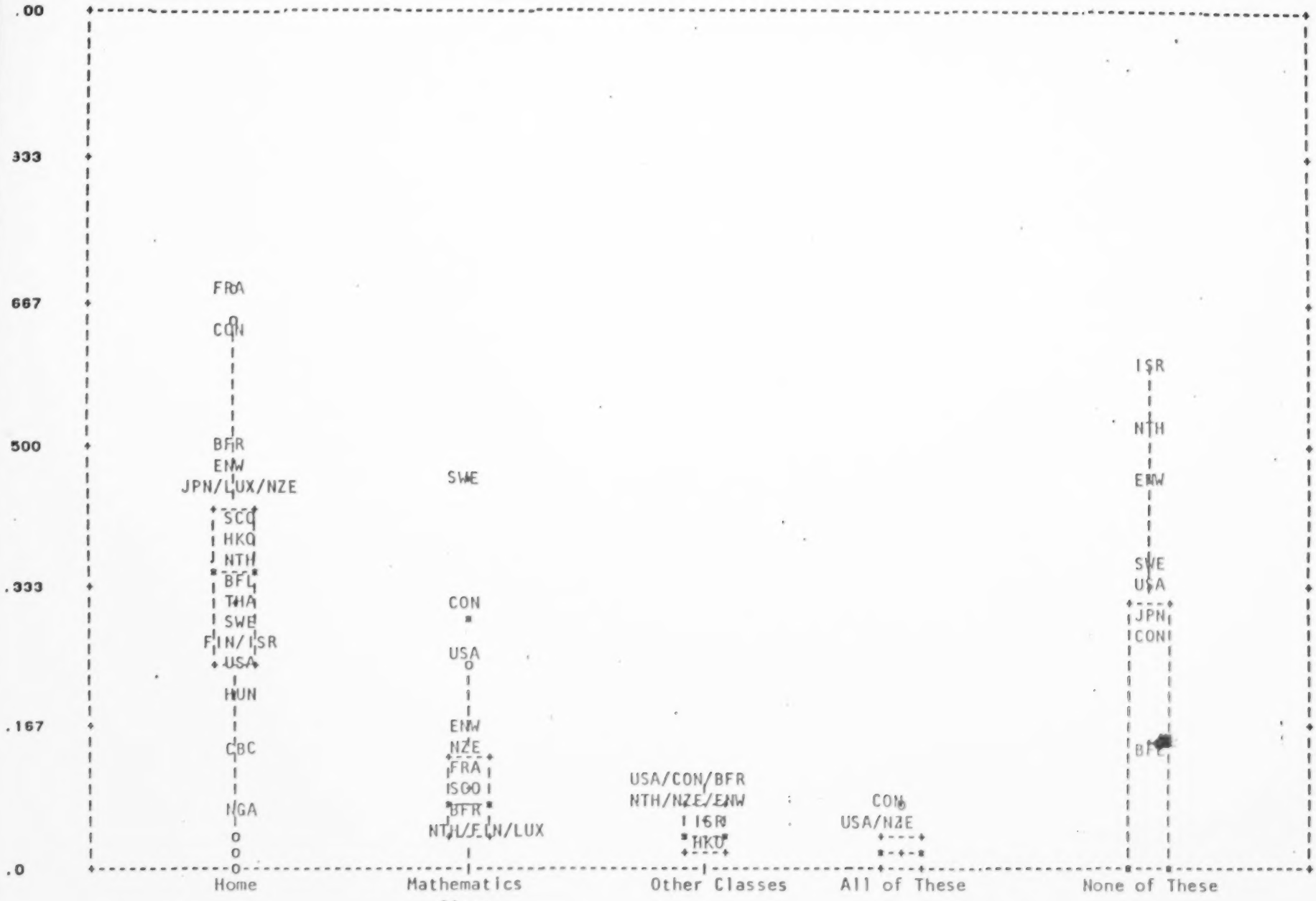


Figure 3.2 Where Programmable Calculators Are Used by Students: (Population B) 1981

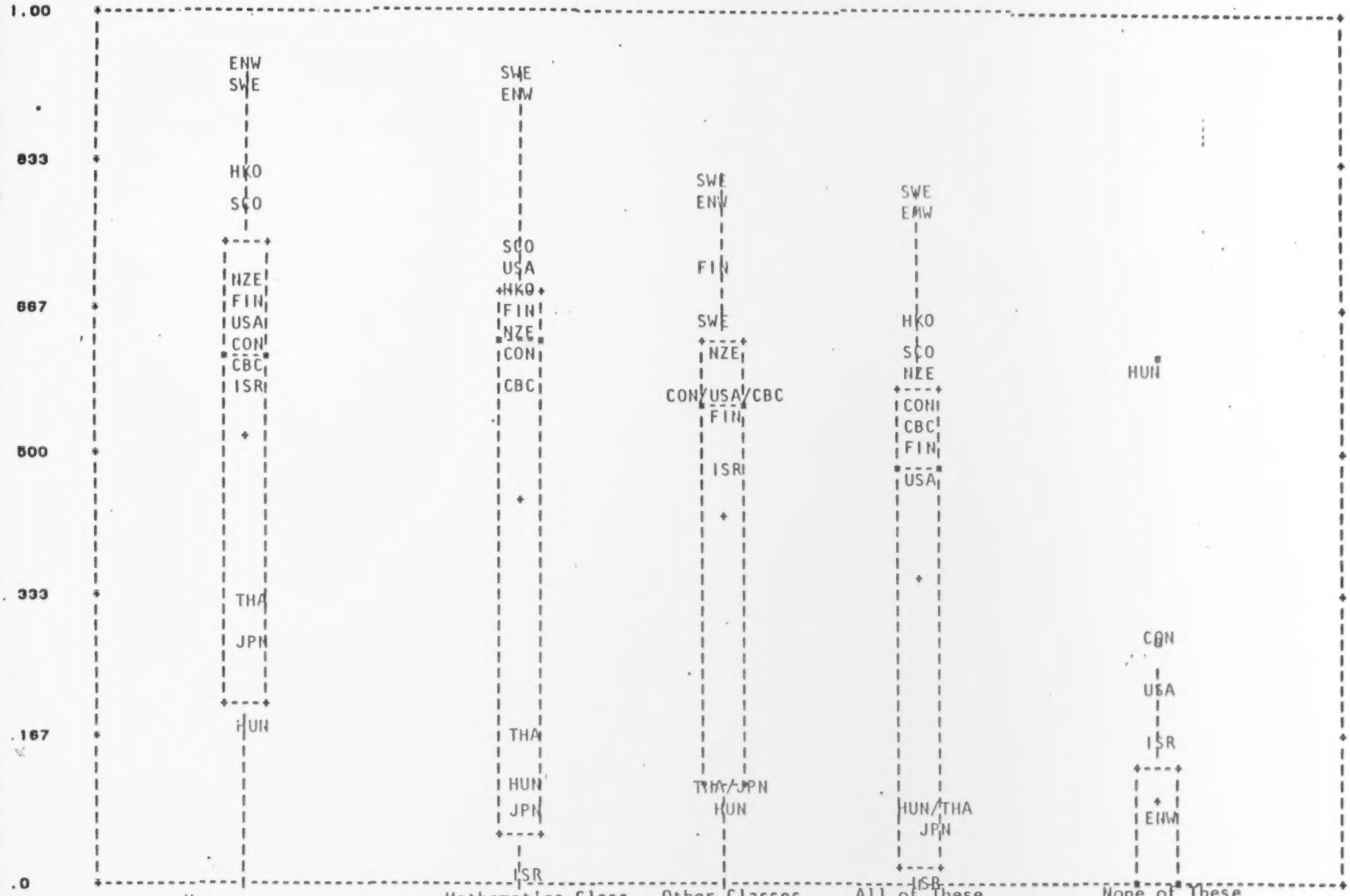


Figure 3.3 Where Computers Are Used by Students: (Population A) 1981

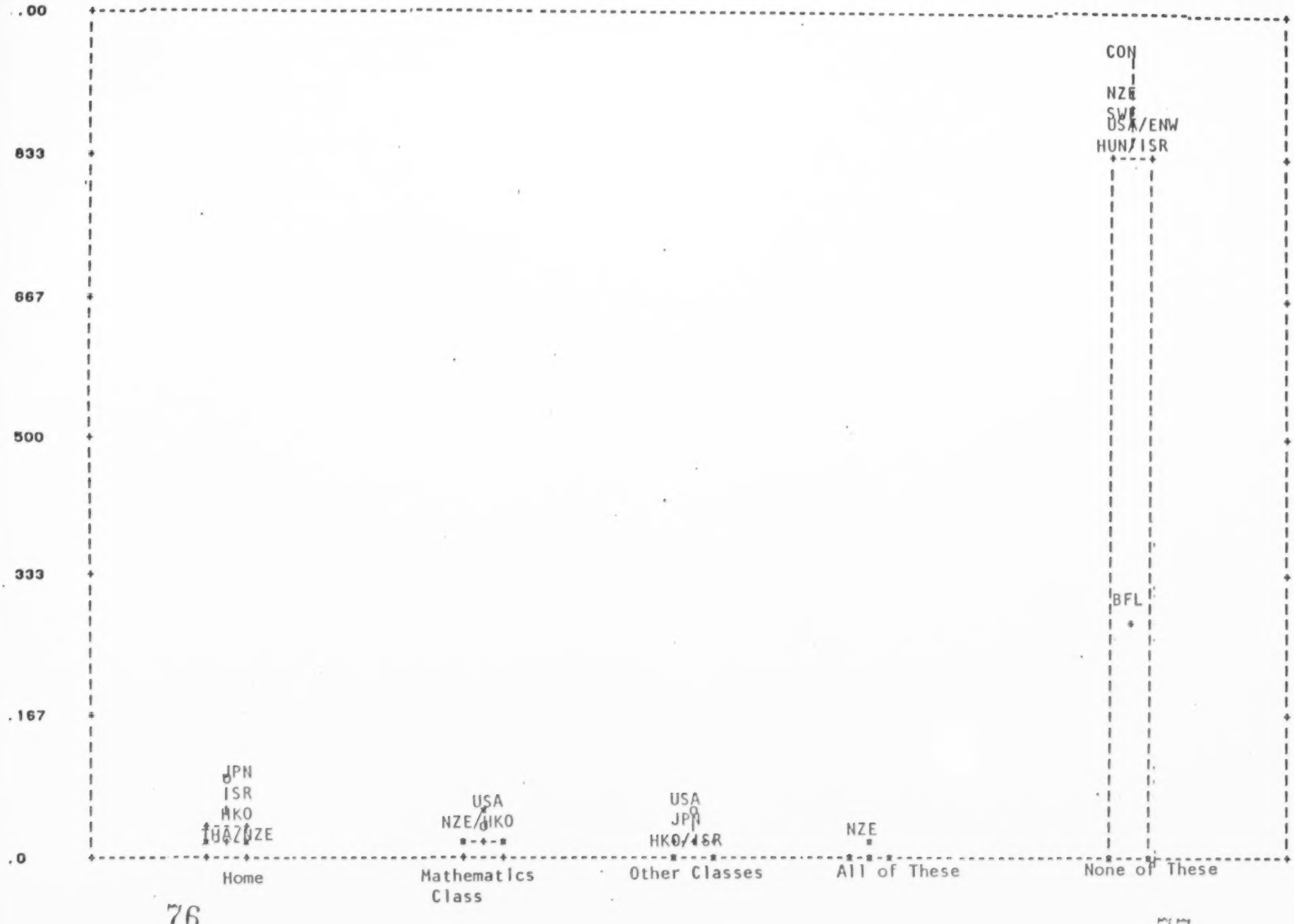


Figure 3.4 Where Computers Are Used by Students: (Population B) 1981

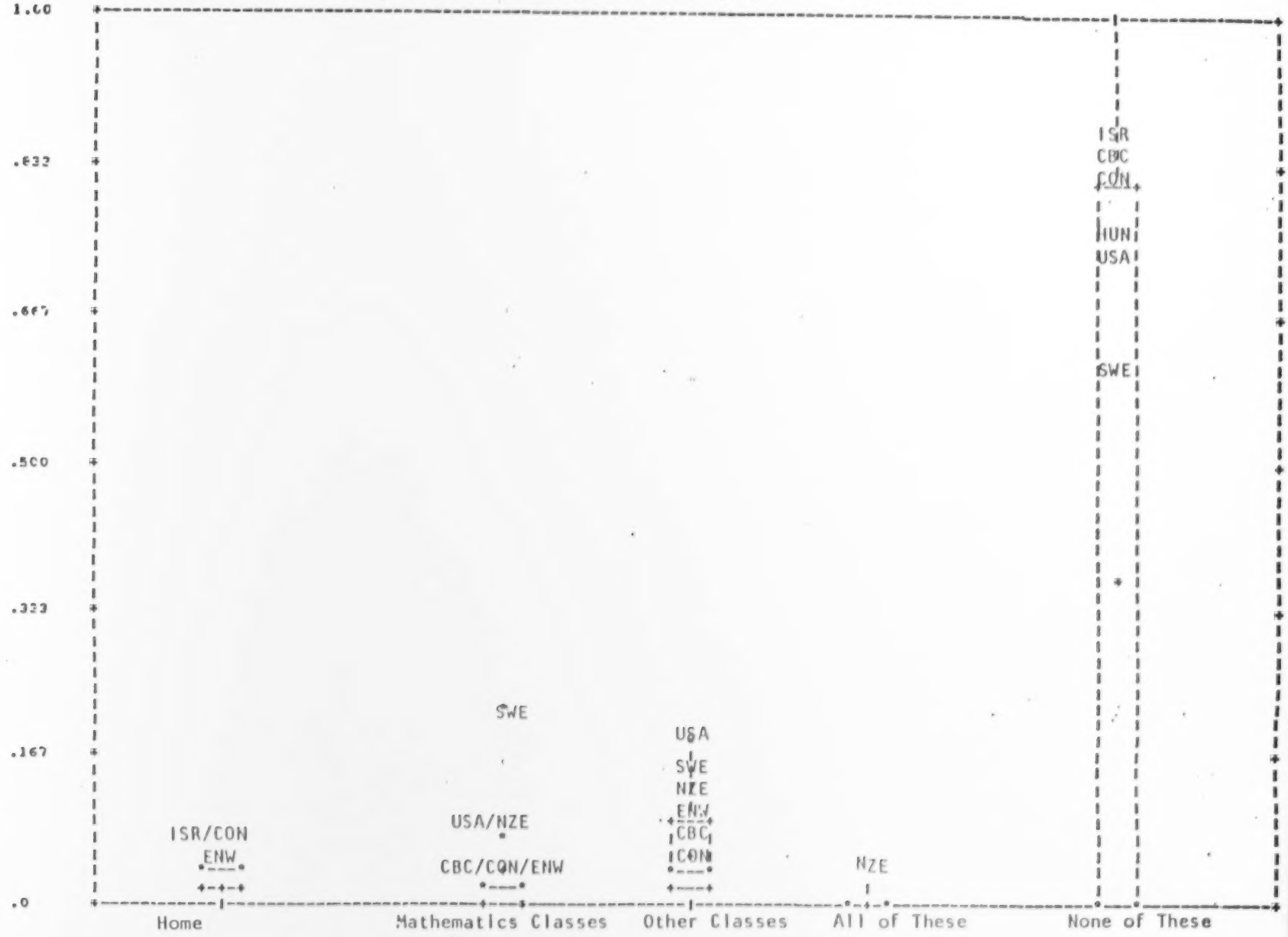


Figure 3.5 Calculating Device Used for Checking Answers by Students: (Population A) 1981

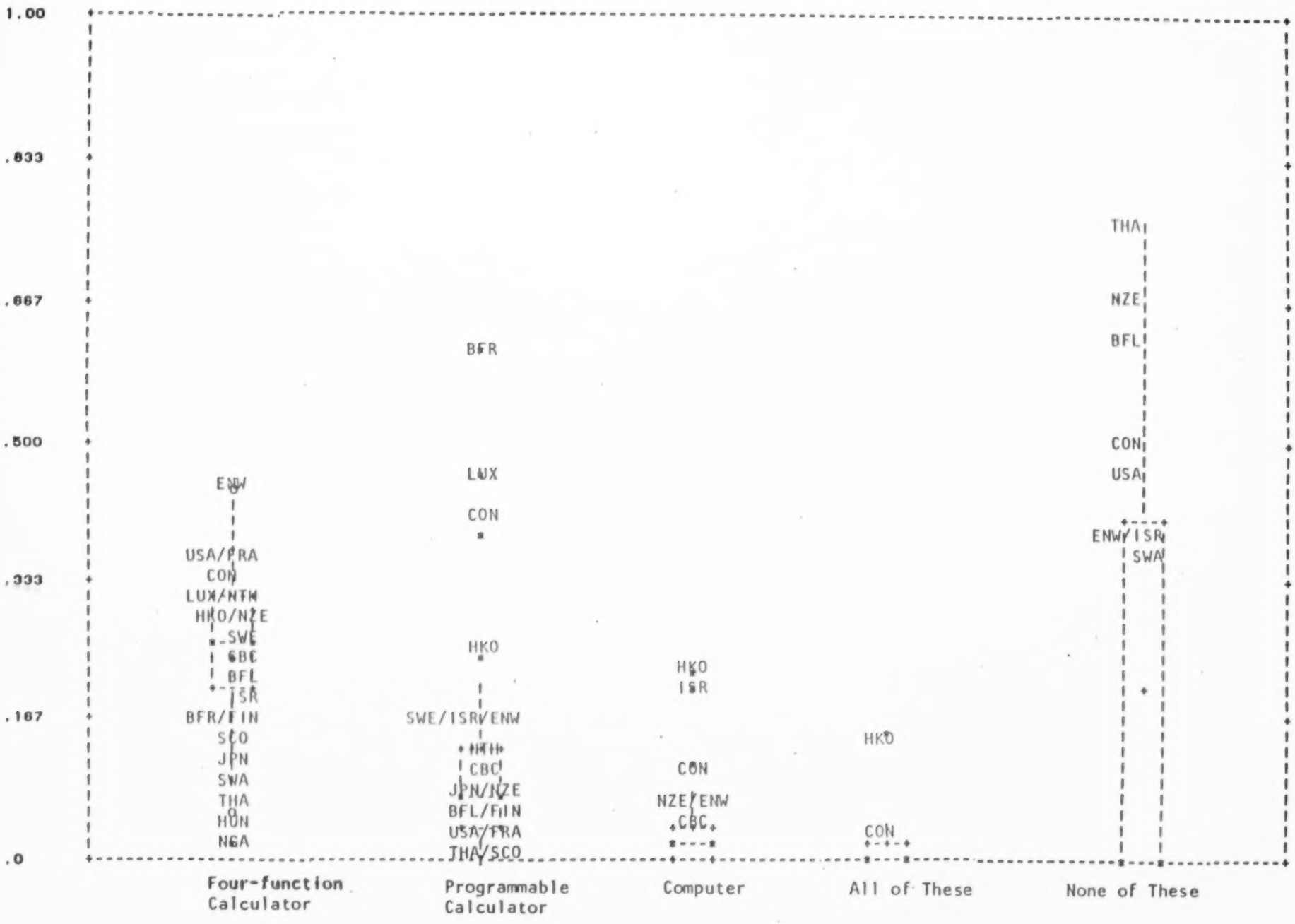


Figure 3.6 Calculating Device Used for Solving Problems by Students (Population A): 1981

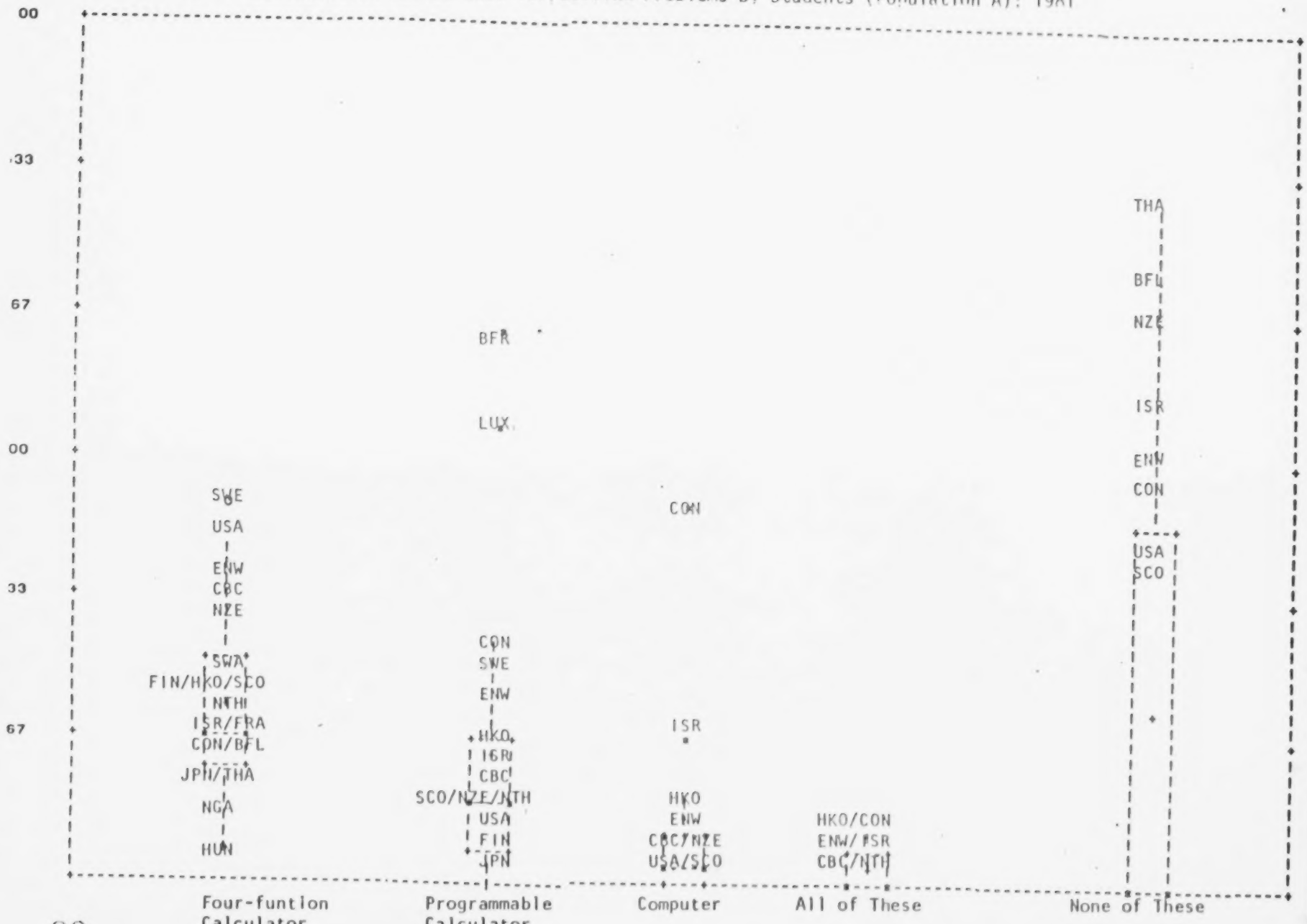


Figure 3.7 Calculating Device Used for Taking Tests by Students (Population A): 1981

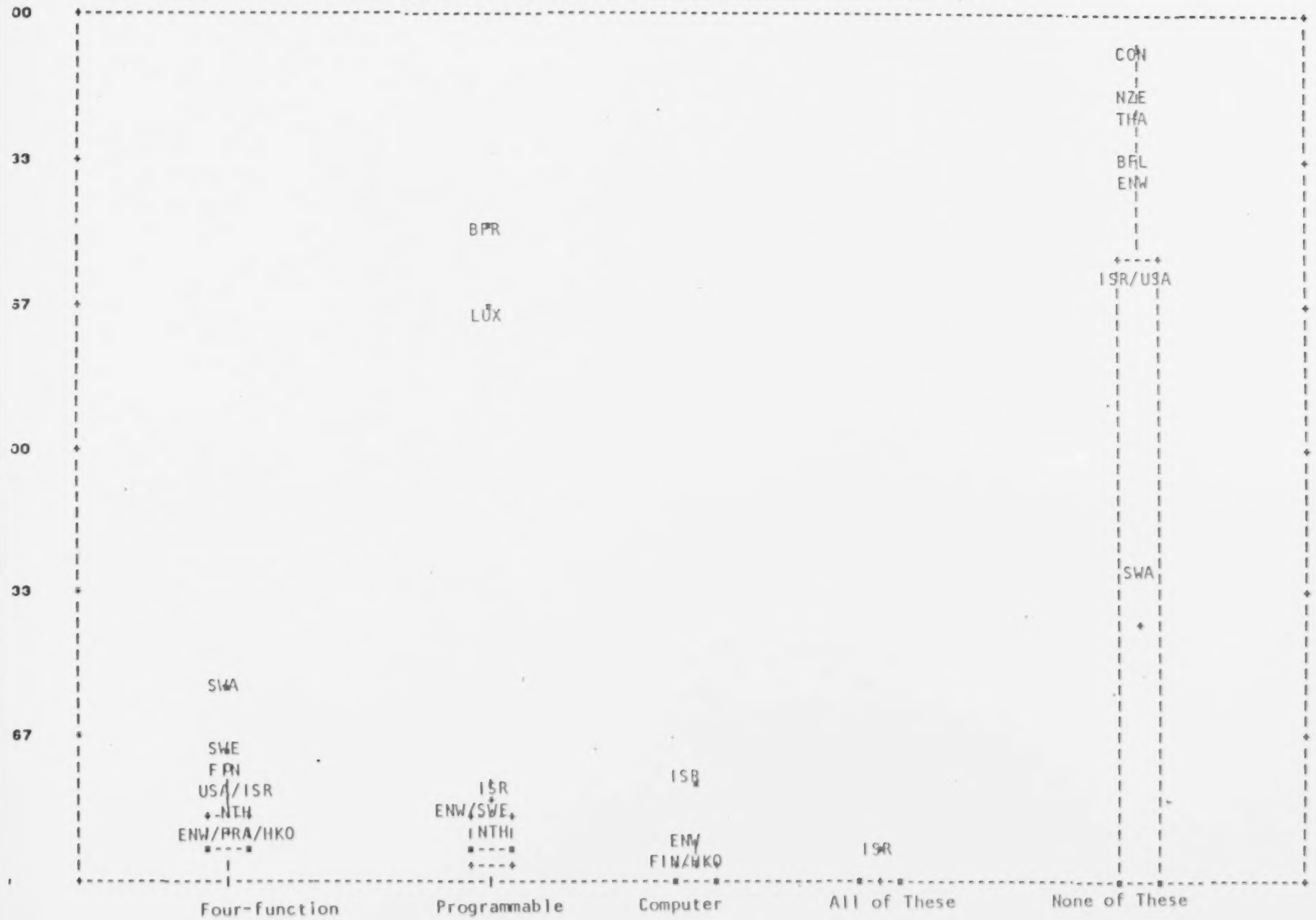


Figure 3.8 Calculating Device Used for Doing Projects by Students (Population A): 1981

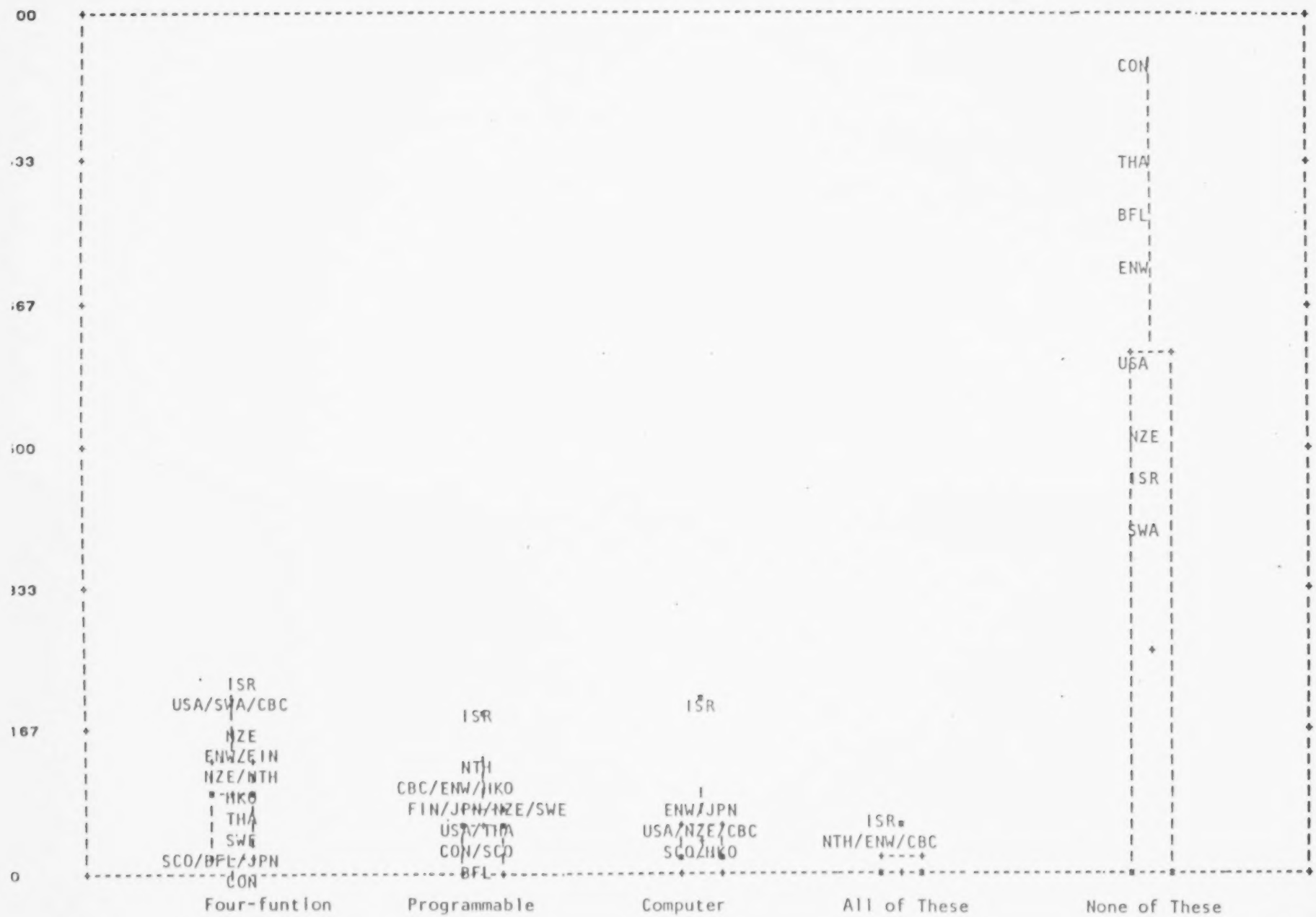


Figure 3.9 Calculating Device Used for Recreation by Students: (Population A) 1981

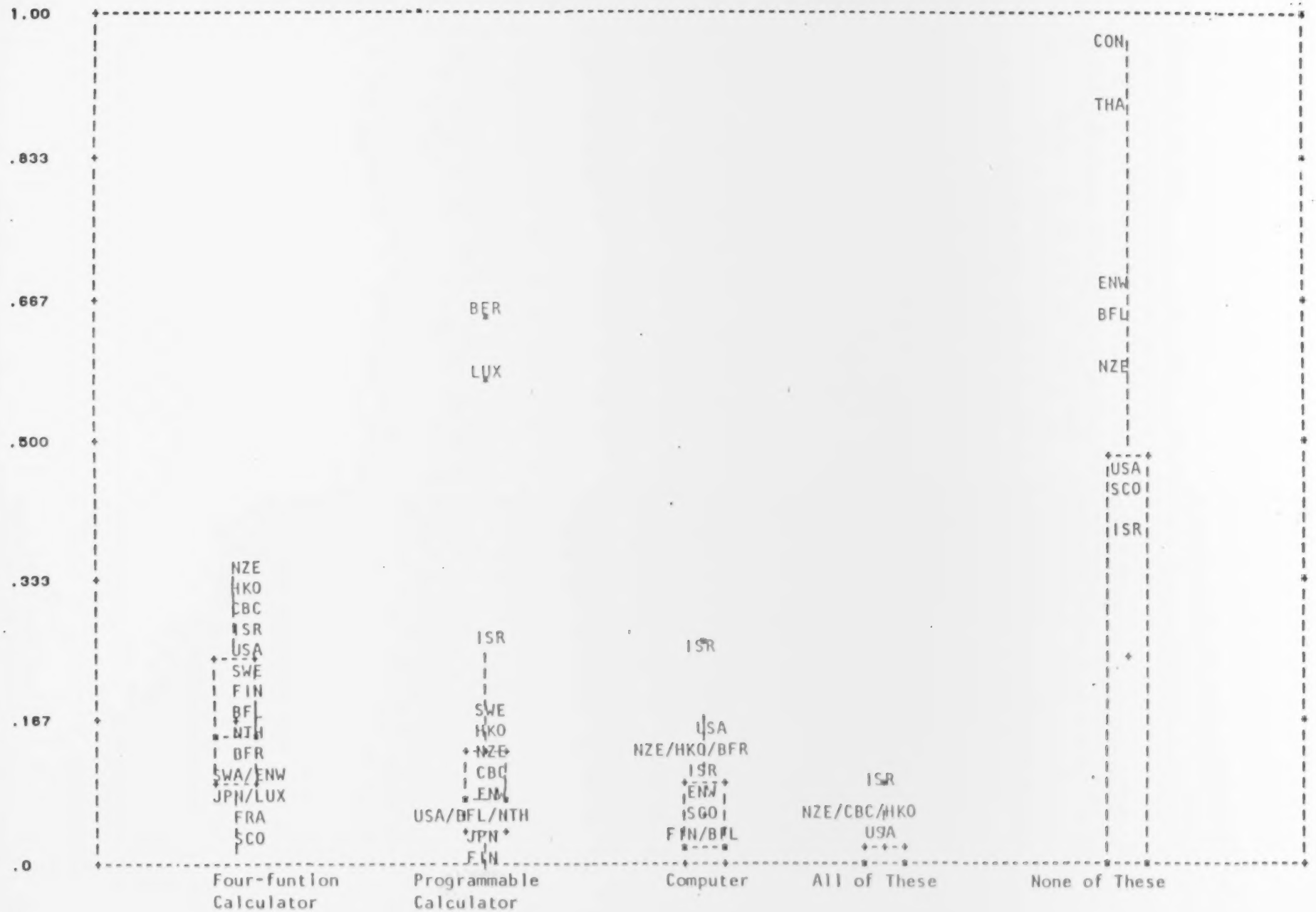


Figure 3.10 Calculating Device Used for Doing Homework by Students: (Population A) 1981

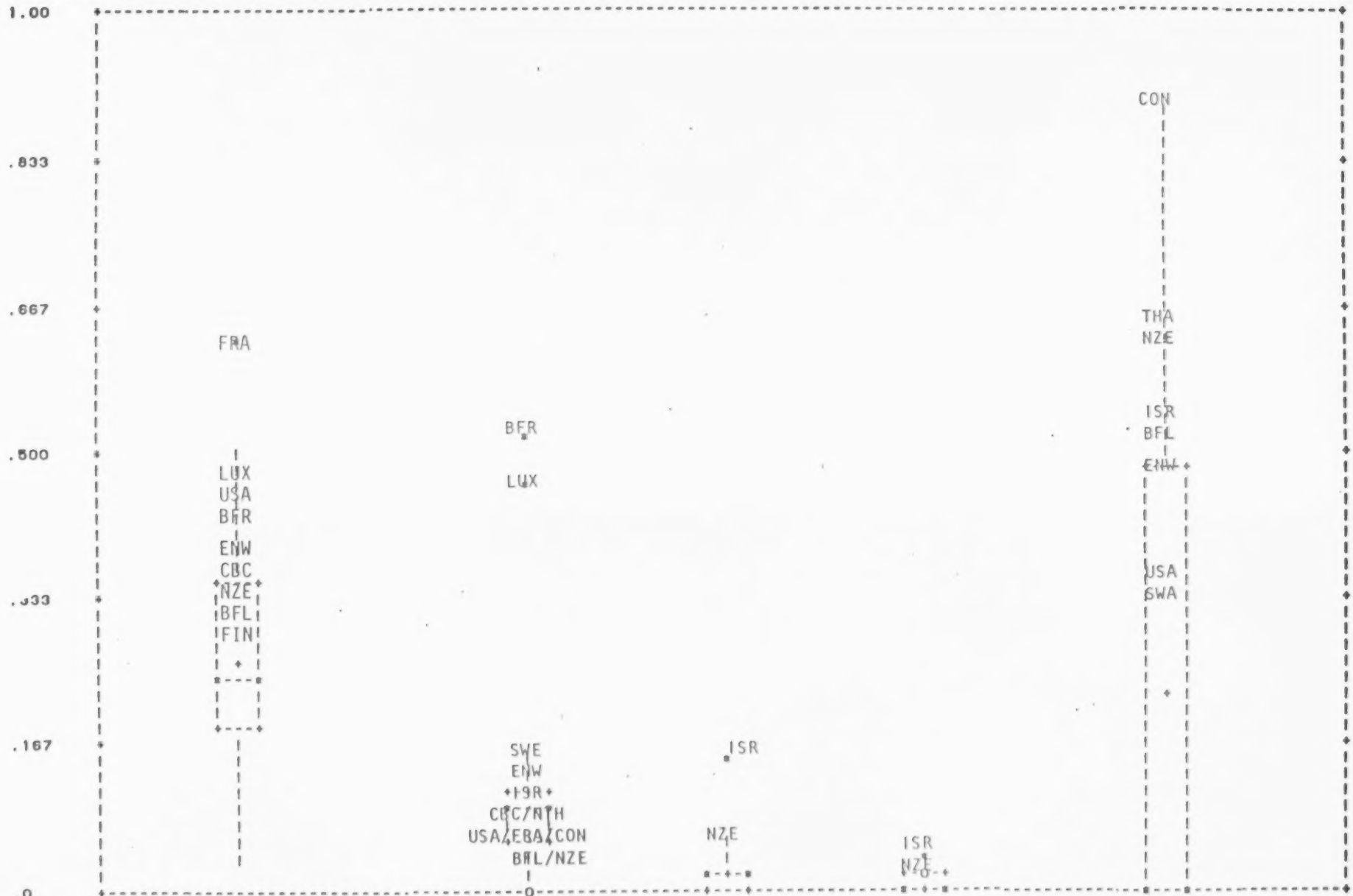
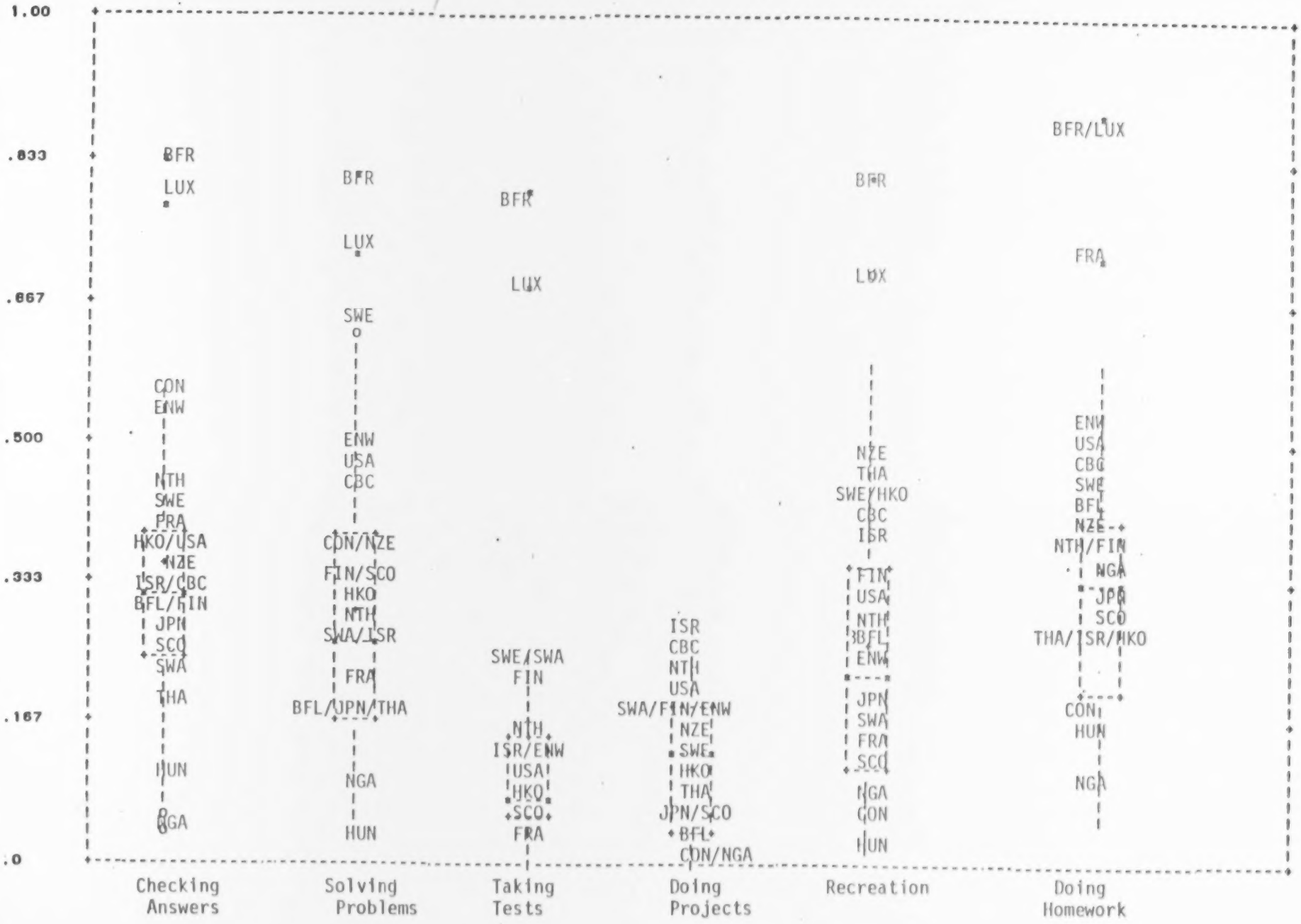


Figure 3.11 Uses Made of the Calculator by Students: (Population A) 1981



3.12 Calculating Device Used for Checking Answers by Students: (Population B) 1981

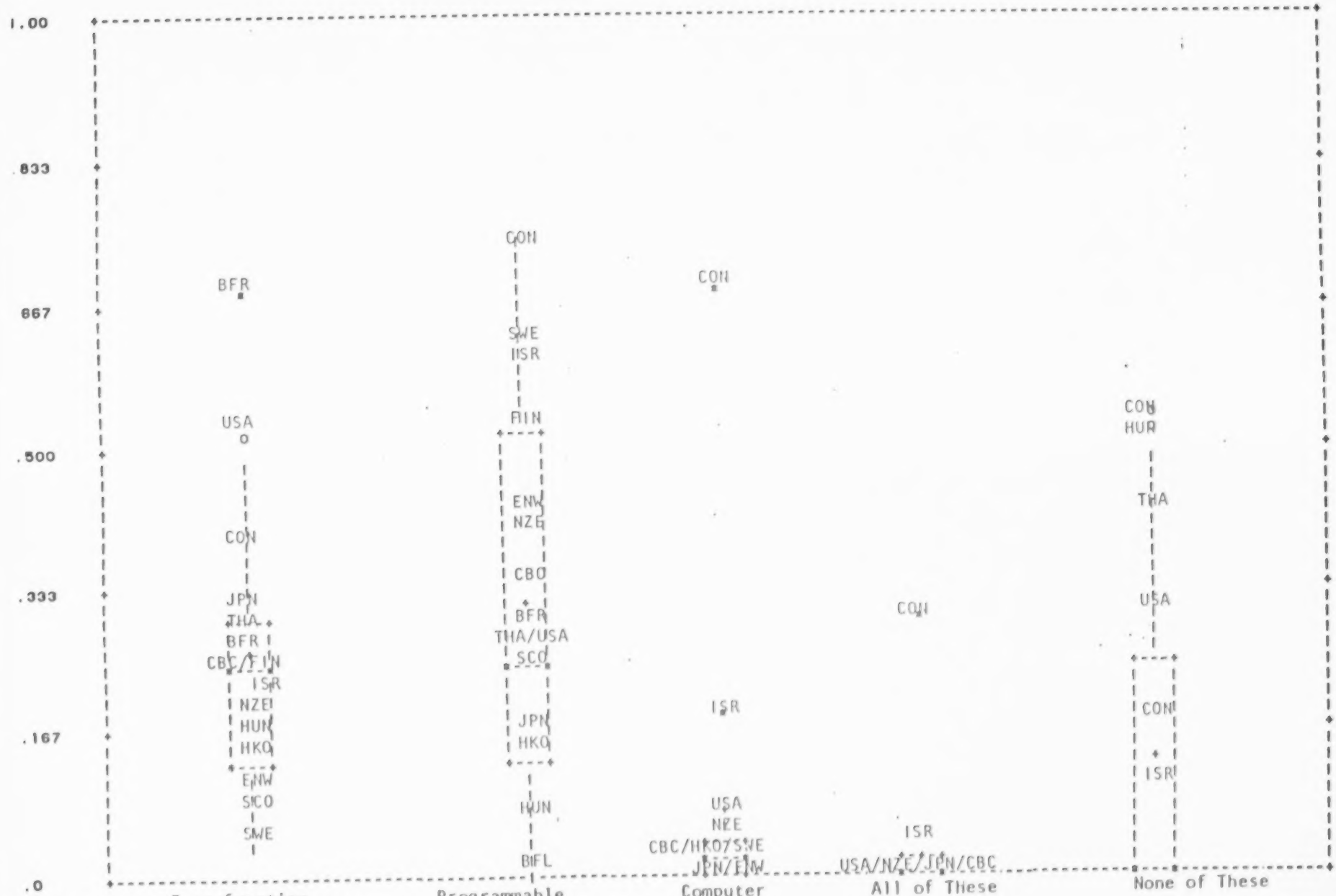


Figure 3.13 Calculating Device Used for Problem Solving by Students: (Population B) 1981

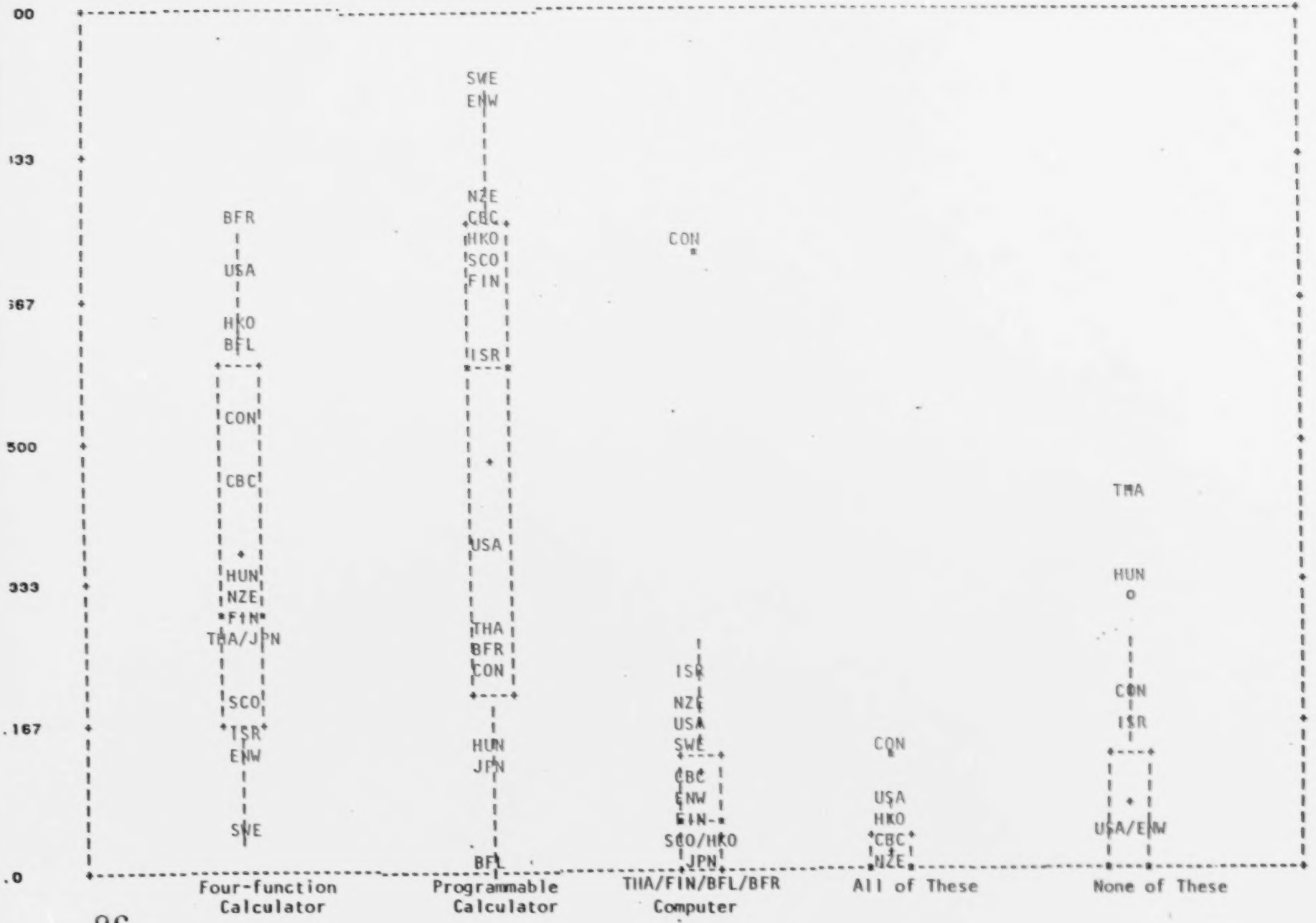


Figure 3.14 Calculating Device Used for Taking Tests by Students (Population B): 1981

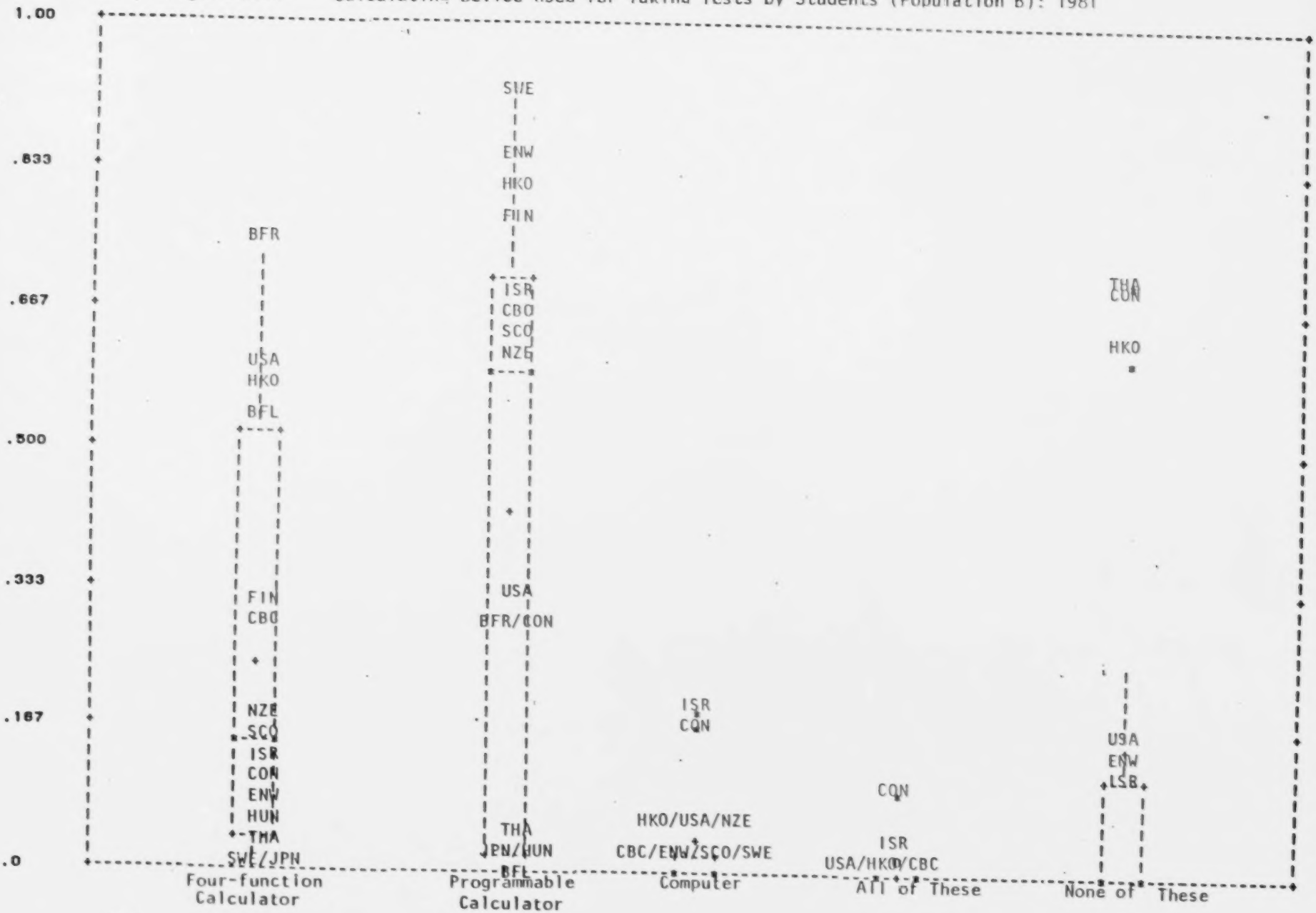


Figure 3.15 Calculating Device Used for Doing Projects by Students: (Population B) 1981

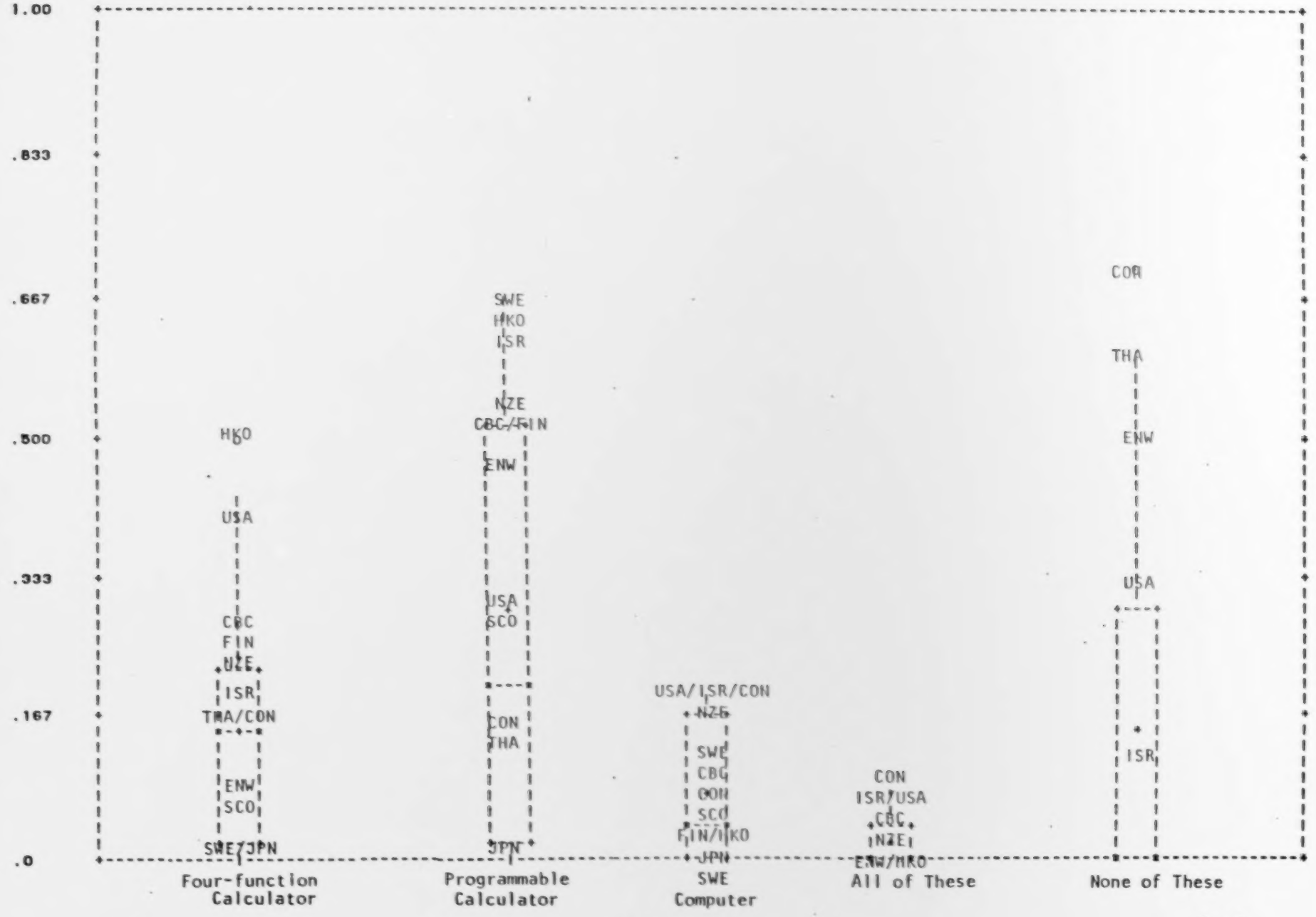


Figure 3.16 Calculating Device Used for Recreation by Students: (Population B) 1981

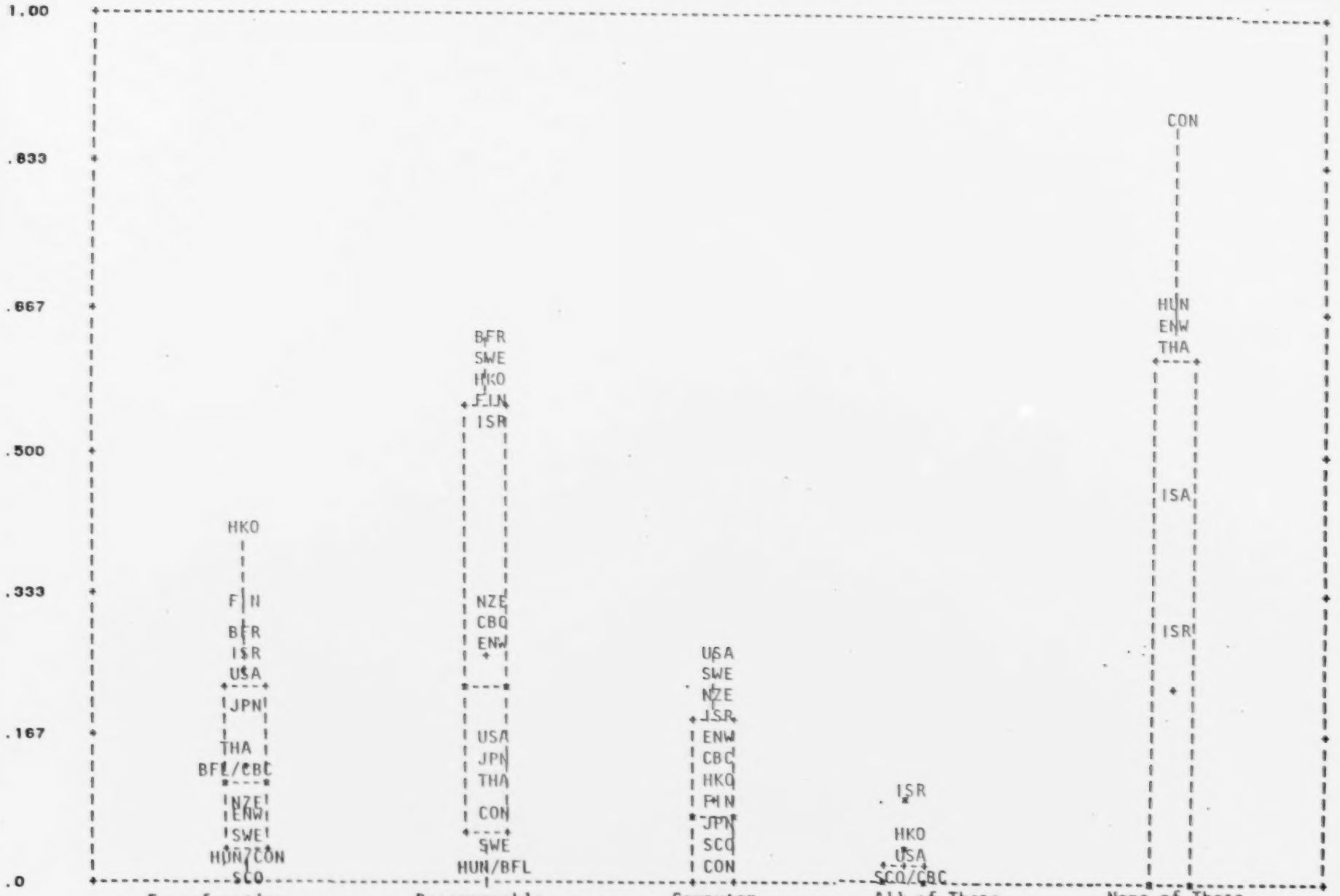


Figure 3.17 Calculating Device Used for Doing Homework by Students (Population B) 1981

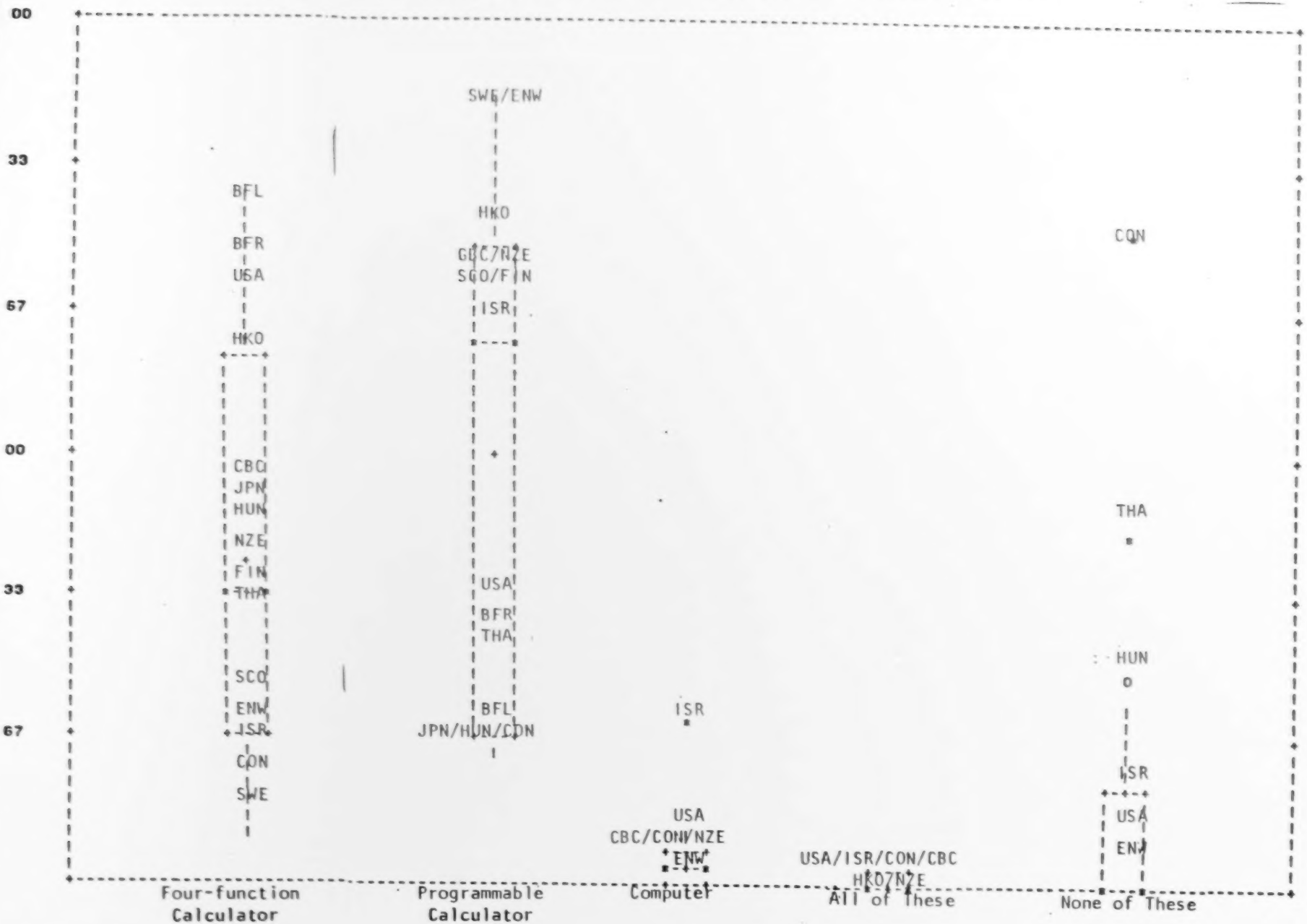


Figure 3.18 Uses Made of the Calculator by Students: (Population B) 1981